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ABSTRACT

An assessment was made of the needs of secondary trade and industrial education curriculum in Indiana. The study also identified those skills and knowledge that are important in trade and industrial occupations in business and industry and in secondary trade and industrial programs. Three surveys were conducted: (1) Business, Industry, and Labor (BIL) Curriculum Needs Survey; (2) Local Curriculum Assessment Survey; and (3) National Curriculum Assessment Survey. The final response rates were as follows: (1) BIL survey--165 of 250 (66 percent); (2) local survey--188 of 250 (75 percent); and (3) national survey--43 of 55 (78 percent). The quantitative data for each of the three instruments were analyzed using descriptive statistical methods and the qualitative information was analyzed using categorical and frequency procedures. Twenty-three recommendations were based on the results of the three studies. (Fourteen references and five appendices are included. The appendices are as follows: BIL curriculum needs survey; local curriculum assessment survey; national curriculum assessment survey; BIL and local survey data table; and skill and knowledge chart.) (NLA)

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Review and Assessment of Secondary Trade and Industrial Education Curriculum

FINAL REPORT

James P. Greenan
Project Director

Project Number: 89-4756 (1828)

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Purdue University
West Lafayette, Indiana

April 1990

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INTRODUCTION

The field of education has been challenged to respond to several national, state, and local initiatives and reports relating to curriculum revision and improvement (Boyer, 1983; Goodlad, 1984; Bell, 1984; National Commission on Secondary Education, 1983; National Commission on Secondary Vocational Education, 1984; Parnell, 1985; William T. Grant Commission on Work, Family, and Citizenship, 1988; Wirth, 1983; Task Force on Education for Economic Growth, 1983). In part, this challenge has been affected by factors such as emerging high technology, changing graduation requirements in states, emphasis on general liberal education; and needs for preparing workers with skills necessary for transitioning into and adapting to changing work environments. The initiatives strongly suggest the need for conceptual and operational approaches to curriculum innovation. The field of vocational education, and specifically, secondary vocational industrial education, has begun to initiate curriculum updating and revision activities (Greenan, 1983; Greenan, 1988; Pautler, 1990; Copa, Plihal, & Johnson, 1986; Copa, Plihal, Scholl, Ernst, Rehm, & Copa, 1985). Initiatives have focused upon technical, basic, and occupational survival skills.

PURPOSE OF THE STUDY

The major purpose of this study was to review and assess the needs of secondary trade and industrial education curriculum in the state of Indiana. The purpose of the study was also to collect (a) data and information regarding the current status of secondary trade and industrial education curriculum in Indiana and across the United States, (b) data and information regarding the current and projected secondary trade and industrial education curriculum needs of business, industry, and labor in the state of Indiana, and (c) data and information that describe the relationship and effectiveness between current secondary trade and industrial education curriculum and business, industry, and labor needs in the state of Indiana. Specifically, the study intended to identify those skills and knowledge that are important in trade and industrial occupations in business and industry and in secondary trade and industrial programs. In addition, the study identified the skill and knowledge levels of entry employees and entry T&I students. Further, the extent to which various important skills and knowledge were taught in secondary trade and industrial programs was identified. New and emerging skill and knowledge areas were also identified. The results of the study should assist personnel in identifying directions for future standards and proficiency

development, and for subsequent curriculum development and revision.

OBJECTIVES OF THE STUDY

1. Conduct two surveys to determine the (a) current status of secondary trade and industrial education curriculum in the state of Indiana, and (b) current status of secondary trade and industrial education curriculum (and model curriculum) in each of the 50 states, District of Columbia, and six surrounding territories.

2. Conduct a survey to determine the current and projected secondary trade and industrial education curriculum needs in the state of Indiana as perceived by business, industry, and labor personnel.

3. Describe the relationship and effectiveness between current secondary trade and industrial education curriculum and current and projected business, industry, and labor needs in the state of Indiana.

4. Enhance communications among business, industry, labor, and education through effective collaboration in secondary trade and industrial education curriculum review and assessment activities.

5. Identify the basic skills required of students in secondary trade and industrial education programs; and, by business, industry, and labor.

PROCEDURES

Population and Samples

Business, Industry, and Labor (BIL) Curriculum Needs Survey

The population for the BIL survey included all persons who are advisory committee members in local secondary T&I programs in the state of Indiana. A letter and two follow-up letters were sent to each of the 56 secondary area vocational directors requesting lists of advisory committee members from all their T&I programs. Fifty of 56 (89.29%) directors returned a total of 1,645 names and addresses. The population for the BIL survey, therefore, was N=1,645. A random sample of 250 advisory committee members was selected and included in the BIL survey.

Local Curriculum Assessment Survey

The population for the local survey included all secondary T&I instructional personnel (teachers, coordinators) and the secondary area vocational directors in the state of Indiana. Lists of personnel were obtained from the Indiana Department of Education. The population for the local survey, therefore, was N=541 secondary T&I instructional personnel and N=56 secondary area vocational directors. A random sample of 250 T&I personnel was selected and included in the local survey. The entire population (N = 56) of secondary area vocational directors was used in the survey.

National Curriculum Assessment Survey

A directory of state T&I supervisors (N=56) was obtained from the United States Department of Education, Office of Vocational and Adult Education. The entire population (except Indiana) of supervisors was included in the National Survey. Therefore, 55 state T&I supervisors participated in the study.

Instrumentation

The Business, Industry, and Labor (BIL) Curriculum Needs Survey, Local Curriculum Assessment Survey, and National Curriculum Assessment Survey instruments were developed using reviews of literature, advisory committee input, and internal analysis. Critical issues and problems relating to curriculum were identified. Several significant research questions evolved. Items were written and appropriate formats were selected. First drafts of the BIL, Local, and National Survey instruments were developed, reviewed by the advisory committee, and revised according to the advisory committee input. Subsequently, five drafts of each survey instrument were similarly reviewed and revised. The fifth and final drafts included demographic information, Likert-type scaled items, and open-ended items. The BIL, Local, and National Survey instruments were then perceived to have an adequate degree of content and face validity. (see Appendices A, B, and C).

Data and Information Collection

The BIL, Local, and National Survey instruments and cover letters were mailed to personnel selected to participate in the study. Four weeks after the initial mailing a follow-up was conducted, and, in four week intervals 2 additional follow-up mailings were also conducted. The final response rates included: (a) BIL survey (165 of 250 = 66%), (b) Local survey (T&I teachers (171) and coordinators (17) = 188 of 250 = 75.20%) and 54 of 56 directors = 96.43%, and (c) National survey (43 of 55 = 78.18%). The data and information collection occurred over a 4-month period.

Data and Information Analysis

The quantitative data for each of the three instruments were analyzed using descriptive statistical methods that included frequencies, means, and standard deviations. The qualitative information was analyzed using categorical and frequency procedures. Both the quantitative data and qualitative information were checked for reliability.

FINDINGS

Business, Industry, and Labor (BIL) Curriculum Needs Survey

The purpose of this survey was to determine the current and projected secondary school vocational trade and industrial education curriculum needs in the state of Indiana as perceived by business, industry, and labor personnel. This survey contained 2 parts: Part I and Part II. Part I included items and a rating scale. Part II included open-ended questions.

One hundred sixty-five of the 250 (66%) randomly selected Business, Industry, and Labor subjects returned surveys. The returned surveys included 6 labor union representatives, 75 management personnel, 40 proprietors, and 36 "other" personnel (not specified (9), sales (5), engineer (3), trades (2), auto mechanic (2), building contractor, partner, salaried staff, technician, city government, residential mortgage lender, owner/manager, teacher, insurance, cosmetology, service worker, temporary help, state government, attorney, employee). In addition, the following types of trade and industrial occupations/ workers were involved in the companies of subjects who responded to the BIL survey.

Types of Trade and Industrial Occupations/Workers	Number of Responses
Electrical	62
Welding and Cutting	60

Foreman, Supervision, and Management Development	57
Construction and Maintenance	56
Machine Shop	50
Electronics	49
Other(s)	46
Drafting	45
Metal Fabrication	44
Air Conditioning	43
Auto Mechanics	43
Instrument Maintenance and Repair	30
Custodial Service	26
Diesel Mechanics	26
Auto Body	19
Graphic Arts/Printing	17
Plastics	17
Metallurgy	16
Small Engine Repair	16
Commercial Art	11
Public Service	10
Commercial Photography	9
Stationary Energy Sources	9
Appliance Repair	7
Business Machine Maintenance	6
Cabinet Making	6
Cosmetology	6
Upholstering	6

Furniture Making	4
Barbering	3
Precision Food Production	3
Aviation	1
Leather Working	1
Commercial Fishery	0
Dry Cleaning	0
Industrial Atomic Energy	0
Maritime	0
Textile Production and Fabrication	0

Others (CNC-Programming (5), Assembly (3), Heating (3), Tool and Die (3), Plumbing (3), Salesman (2), Heavy Equipment Operator (2), Maintenance (temperature control) and Installation (2), Auto Parts Store (2), Laboratory Technicians (2), Woodworking (2), Retail (2), Office Skills (2), Accountants, Automatic Machine Shop, Communications (Telephone Service), Material Analyst, Production of Sand Gravel Stone, Concrete, Needliners, FAB-JET Engine Parts, Stamping, Insurance, Printing (metal), Secretarial, Broadcasting, Surveying, Customer Service Industry, Truck Drivers, Commercial Refrigeration, Commercial Gas, Pipe Fitters, Financial Industry, Computer Operations, Carpets, Engineers, HVAC, Automotive Manufacturing, Dimension Parts for Industry, Masonry, Glazier, Sunroofs, State Government, Boat Top and Covers, Employment Training Services)

The findings of the BIL Survey result from the items in the instrument and are organized around the research questions posed for the study. The findings include quantitative data from the item ratings and qualitative information from the open-ended items. The reliability of the BIL survey is .999 for the "Importance" scale and .987 for the "Skill" scale. The research questions and findings include:

1. What is the degree of importance of, and what is the extent of entry employee mathematics skills and knowledge in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

Appendix D presents the sample sizes (n's), means ($\bar{x}$), frequencies, and standard deviations (SD) for each skill/knowledge area and for each respondent group, and for the "Importance" and "Entry Skill/Knowledge Level" scales for the BIL survey instrument. The mean responses may be interpreted as follows:

"Importance" Scale

$\bar{x}$ = 1.00-2.33 (not important)
$\bar{x}$ = 2.34-3.66 (moderately important)
$\bar{x}$ = 3.67-5.00 (very important)

"Entry Skill/Knowledge Level" Scale

$\bar{x}$ = 1.00-2.33 (low)
$\bar{x}$ = 2.34-3.66 (average)
$\bar{x}$ = 3.67-5.00 (high)

The labor union representatives, management, proprietors, and other respondents consistently ranked the basic mathematics skills (whole numbers, fractions, decimals, percent, mixed operations, measurement and calculation, and estimation) as being very important in their companies. Their collective responses (i.e., $\bar{x}$ > 3.67) indicated that each of the basic mathematics skills and knowledge is very important in the various companies that include trade and industrial occupations/workers. However, the respondents indicated that the higher order mathematics skills are only moderately important, and,

suggested that trigonometry and especially calculus have minimal importance in their companies involving trade and industrial occupations/workers.

The labor union representatives, management, proprietors, and other personnel in every case indicated that their employees possessed only average entry skill/knowledge levels ($\bar{x}$ = 2.34-3.66) in basic mathematics even though these skills are very important in their companies. They also indicated, as would be expected, that the entry level higher order mathematics skills and knowledge of employees is low ($\bar{x}$ = 1.00-2.33). Entry employees' higher order mathematics skills are often lower than necessary even though these skills are, in general, at least moderately important in the companies. Appendix E illustrates the importance of skills and knowledge, and, the entry skill and knowledge levels of employees in companies.

2. What is the degree of importance of, and what is the extent of entry employee <u>communications skills and knowledge</u> in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

The BIL respondents individually and collectively rated each of the communications skills as very important ($\bar{x}$ = 3.67-5.00) thus indicating that words and meanings, reading, writing, speaking, and listening skills and knowledge are essential in their companies. However, in all but 1 case the labor union representatives, management, proprietors, and other personnel indicated that the entry skill/knowledge

levels of their employees were only average ($\bar{x}$ = 2.34-3.66). Therefore, communications skills and knowledge in companies are very important. However, entry employees possess only average levels of communications skills and knowledge.

3. What is the degree of importance of, and what is the extent of entry employee interpersonal relations skills and knowledge in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

The labor union representatives, management personnel, proprietors, and other personnel indicated that interpersonal relations skills such as work behaviors, instructional and supervisory conversations; teamwork; and change, flexibility, and adaptability skills were very important ($\bar{x}$ = 3.67-5.00); however, social conversations were only moderately important ($\bar{x}$ = 2.34-3.66) in their companies. For each interpersonal relations skill, all the BIL respondents indicated that the entry skill/knowledge levels of employees were average ($\bar{x}$ = 2.34-3.66). This finding suggests that entry level employees possess interpersonal skills and knowledge below which they need to function in companies.

4. What is the degree of importance of, and what is the extent of entry employee reasoning skills and knowledge in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

The BIL survey respondents in every case indicated that reasoning skills and knowledge that include verbal

reasoning, problem solving, and planning were very important ($\bar{x}$=3.67-5.00) in their companies. Labor union representatives, management personnel, proprietors, and others also agreed consistently that the entry skill/knowledge levels of employees with respect to reasoning are only average ($\bar{x}$ = 2.34-3.66). This finding suggests that entry level employees possess reasoning skills below the expectations and skill importance level of BIL personnel.

5. What is the degree of importance of, and what is the extent of entry employee <u>science skills and knowledge</u> in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

In general the labor union representatives, management personnel, proprietors, and other personnel indicated that, except for a few exceptions science skills and knowledge in areas such as general science, earth and atmospheric science, biology, chemistry, and physics have minimal importance ($\bar{x}$ = 1.00-2.37) in their companies. However, there appeared to be some disagreement among BIL survey respondents regarding importance as suggested by the relatively large standard deviations (SD $\geq$ 1.00). Overall, the BIL survey respondents agreed that their entry level employees possessed average ($\bar{x}$ = 2.34-3.66) general science knowledge, however, in the other science areas the levels of skills and knowledge were low. These findings suggest that since the expressed importance of science skills and

knowledge is low, the generally low level of entry employee skills/knowledge in science does seem to be a major concern of the BIL respondents. Individual science skills and knowledge apparently are important in specific occupational areas in which employers require different levels of skills.

6. What is the degree of importance of, and what is the extent of entry employee computer technology skills and knowledge in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

The labor union representatives, management personnel, proprietors, and other personnel generally rated computer technology skills and knowledge such as understand and use terminology, keyboarding, word processing, data processing, business applications, programming, and networking as having moderate importance in their companies. However, there appears to be a relatively large disparity of disagreement with respect to their importance as suggested by the standard deviations (SD $\geq$ 1.00) within and across the BIL survey respondents. In a few cases, respondents placed minimal importance on word processing and programming skills and knowledge. Similarly, the BIL survey respondents generally rated the entry computer technology skill/knowledge levels of their employees as being average, although most respondents indicated that their employees had low levels of programming and networking skills. However, there is a seemingly and very large degree of disagreement within and among the BIL survey respondents regarding their

employees' entry level skills and knowledge as indicated by commonly large standard deviations (SD $\geq$ 1.00). The data suggest that while computer technology skills have moderate importance in companies, and entry employees have low to average skill/knowledge levels, there appears to be a relatively large degree of disagreement within and among labor union representatives, management personnel, proprietors, and other personnel.

7. What is the degree of importance of, and what is the extent of entry employee general occupational skills and knowledge in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

In every instance the BIL survey respondents indicated that general occupational skills and knowledge such as understand and follow safety rules and procedures for materials, tools, and equipment; recognize signs and symbols in the workplace; and identify and determine the correct materials, tools, and equipment needed to accomplish a task are very important ($\bar{x}$ > 4.50) in companies. However, the entry skill/levels of their employees almost without exception are in the average range. The data suggest that there is relative agreement that the general occupational skills of entry employees are far below requirements in relation to the importance of general occupational skills and knowledge in the companies of the BIL survey respondents.

8. What is the degree of importance of, and what is the extent of entry employee job - specific skills and knowledge in various companies that include trade and industrial occupations/workers as indicated by labor union representatives, management, and proprietors?

The labor union representatives, management personnel, proprietors, and other personnel consistently rated job - specific skills to be very important ($\bar{x} > 4.36$) in their companies. However, as was the case in most of the other skill and knowledge areas, the entry level job - specific skills of employees were considered only average. There was relative agreement on both importance and entry level skills among personnel. The data suggest that employees enter their companies with job - specific skills and knowledge below the requirements and expectations of employers.

9. What are some important new and emerging technical skill and knowledge areas (or occupations) in the workplace?

The individual BIL survey respondents listed the following as some important new and emerging technical skill and knowledge areas (or occupations) in the workplace:

(8) - S.P.C., Process controllers, Programmed machinery

(7) - CAD/CAM systems

(5) - Knowledge of computer and electronic equipment repair

(4) - Robotics

(4) - Laser technology

(4) - CNC controls

(3) - People (relating) skills

(3) - Word processing and programming skills

(2) - Team leadership

(2) - Basic chemical/mathematics/life science

(1) - Skills area PLC computers

10. Are employers interested in hiring a generalist or specialist?

Seventy-two of the BIL survey respondents indicated that employers are interested in hiring a generalist. Thirty-eight of these respondents reported that companies desire to employ persons possessing basic skills and are willing to provide the needed specific job training. Sixty-two of the BIL survey respondents suggested that employers are interested in hiring a specialist. Another 11 respondents indicated that the interest in hiring a generalist or specialist is dependent upon the individual employer. It was also noted that employers desire to hire persons who are concerned about the overall best interests of the business or industry.

11. Do business, industry, and labor need to increasingly develop partnerships with secondary school trade and industrial education programs?

One-hundred twenty-three of the BIL survey respondents indicated that business, industry, and labor need to increasingly develop partnerships with secondary school trade and industrial education programs. Only 12 respondents reported that such partnerships were unnecessary. The labor union representatives, management personnel, proprietors, and other personnel provided further comments regarding business, industry, and labor

partnerships with secondary school trade and industrial education programs.

(35) - Industry or business needs to be involved with the training and tailoring of its prospects and communicating what industries' needs are.

(21) - More intern type programs including on-the-job-training, DECA, and cooperative programs

(3) - Have teachers spend time in factories to know what is really needed and to gain current knowledge.

(2) - Knowledge of computer programming

(2) - Financial and technical assistance

(2) - Counselors do not support vocational education, work to remove the stigma of vocational education.

(2) - Modern equipment

(1) - Need to work with adults to get a better schedule of classes offered in evening hours.

(1) - Vocational schools and others are too competitive with private industry; very critical to take our means of support to rural areas.

(1) - Need problem solving forums involving undergraduate engineers where by actual plant problems can be solved by undergraduate teams giving them a "feel" for the workplace and working in groups.

(1) - In our field manual drafting techniques are important, however, are not addressed in schools and colleges.

(1) - Funding, equipment, help support classes, help set up classes that will help people to work, not classes that end up doing nothing

12. How can ongoing adequate, quality, and effective trade and industrial education curriculum that is responsive to continuous change in the labor market be assured?

The BIL Survey respondents offered the following perspectives with respect to maintaining adequate, quality,

and effective trade and industrial education curriculum that is responsive to continuous change in the labor market:

(34) - Involving industry and others more directly, so their specific needs will be known, therefore, students can be better educated in a vocational area.

(12) - Watch the market, teach what is needed, and communicate with industry.

(6) - Keep instructors and equipment up-to-date.

(4) - Go back to basics, reading skills and comprehension, problem solving, mathematics, and communication.

(4) - Need more hands-on type of programs to increase knowledge or appreciation including internships, apprenticeships, cooperative programs, and others.

(3) - Establish good work habits and better attitudes.

(3) - Need adequate funding.

(3) - Teachers should be taught to teach and students encouraged to learn.

(2) - Encourage better students to enroll.

(1) - Require training/testing of instructors.

(1) - Trade schools and high schools need to inform students of all the different career opportunities available.

13. Are companies involved in trade and industrial education advisory committees (e.g., input in curriculum updating, involved in equipment decisions)?

One-hundred and eleven BIL survey respondents reported that they or their companies were involved in trade and industrial education advisory committees. Thirty-eight respondents indicated that they or their companies were not involved in advisory committees. Of the 111 BIL survey respondents who reported that they or their companies were

involved in advisory committees, 91 indicated that their involvement was productive (e.g. that their or their companies' input had been used), and only 12 indicated that their involvement was nonproductive. In addition, the labor union representatives, management personnel, proprietors, and other personnel provided further comments such as activities in which they or their companies have been involved:

(42) - Advisory boards including members from high schools and vocational schools

(5) - Have visited with students/student contact

(4) - "Partnership in Education"

(4) - Judging student contests

(3) - Speaker at career day / involved in career day activities

(3) - Advised on teaching material, equipment and educational methods that would prepare people for the building trades

(2) - Cooperative program used

(2) - Additional training and/or schooling is paid for by the company if an employee wants to take advantage of it.

(2) - Lectures, speeches, practical applications in a classroom, plant tours

(1) - Ivy Tech assistance in financial, instruction, and teaching aids

(1) - Workshops

(1) - Helped with IVTC and ASE Certification process

(1) - Most disturbing issue - when ideas are accepted change through bureaucracy takes too long!

(1) - High school office education

(1) - Tech Prep

(1) - Involvement with IVTC and Purdue is productive

(1) - Electronics trade

(1) - Job Training Partnership Act

(1) - Union; Career Education Center Builders, Inc.; and NECA

(1) - In meeting with school officials

14. What are further comments on issues covered in this survey; or comments on issues not covered in this survey that relate to the education and training needs of business, industry, and labor?

Some of the BIL survey respondents also provided additional comments that related to the education and training needs of business, industry, and labor:

(4) - Business, industry, and education need to work together.

(4) - Reading skills, common sense, ability to analyze problems and react, mathematics, communications, basics are needed in the curriculum.

(2) - We are happy with our program.

(2) - Keep employers up-to-date on all the latest technology pertinent to their jobs.

(1) - In the highly competitive market we find ourselves in most manufacturing industries unable to afford to give personnel the education and training they need.

(1) - Most Vocational Education programs are perceived as dumping grounds for problem students.

(1) - The real job opportunities and real employment needs are in the high technology industry workplace.

(1) - Need a large amount of internships.

(1) - Lack of concern from parents is a problem.

(1) - Need to start adult training in Indiana.

(1) - Coordinate with high schools to recruit individuals prior to graduation.

Local Curriculum Assessment Survey

The purpose of this survey was to determine the current status of secondary trade and industrial education curriculum in Indiana as perceived by local vocational education personnel. This survey contained 2 parts: Part I and Part II. Part I included items and a rating scale. Part II included open-ended questions.

One hundred eighty-eight of the 250 (75.20%) randomly selected T&I personnel (teachers, coordinators) and 54 of the 56 (96.43%) of the local vocational directors returned surveys. The returned surveys included 171 T&I teachers, 17 industrial cooperative education coordinators, and 54 local vocational directors. In addition, the following types of courses or programs were taught or supervised by subjects who responded to the local survey.

Courses or Programs Taught or Supervised	Number of Responses
Auto Mechanics	80
Construction and Maintenance	69
Welding and Cutting	57
Machine Shop	53
Electronics	50
Drafting	46
Auto Body	44
Industrial Cooperative Training	41
Graphic Arts/Printing	39
Cosmetology	29

Small Engine Repair	28
Electrical	27
Air Conditioning	17
Metal Fabrication	15
Diesel Mechanics	14
Precision Food Production	12
Custodial Service	9
Cabinet Making	8
Commercial Art	5
Appliance Repair	4
Furniture Making	4
Barbering	3
Metallurgy	3
Plastics	3
Upholstery	3
Aviation	2
Commercial Photography	2
Foremanship, Supervision, and Management Development	2
Business Machine Maintenance	1
Dry Cleaning	1
Instrument Maintenance and Repair	1
Maritime	1
Textile Production and Fabrication	1
Commercial Fishery	0
Industrial Atomic Energy	0
Leather Working	0

Public Service	0
Stationary Energy Sources	0

Others (Building Trades (7), Woods/Carpentry (5), Business Office Occupations (4), Data Processing (3), Nursing (3), Home Economics (2), Blueprint Reading (2), Heating/ Ventilation (2), Air Conditioning and Refrigeration (2), Marketing (2), Automated Manufacturing Tech/Robotics (2), Computer Aided Drafting (2), Allied Health (2), Medical Assistant/ Health Occupations (2), Accounting (2), Transportation, Baking, Engine Rebuilding, Layout and Fitting, Agriculture, Fire Science, Computer Programming, Plumbing, Dental Assisting, Crankshaft Grinder, Computer Maintenance Repair, Masonry, Painting and Decorating, Building Maintenance, Secretarial, Disadvantaged/Handicapped Reading and Math, Industrial Laboratory, Precision Machinery, Agricultural Power)

The findings of the Local Survey result from the items in the instrument and are organized around the research questions posed for the study. The findings include quantitative data from the item ratings and qualitative information from the open-ended items. The reliability of the Local Survey is .996 for the "Importance" scale, .991 for the "Skill" scale, and .992 for the "Instruction" scale. The research questions and findings include:

1. What is the degree of importance of, and what is the extent of entry student <u>mathematics</u> skills and knowledge, and are mathematics skills taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

Table 1 presents the sample sizes (n's), means ($\bar{x}$), frequencies, and standard deviations (SD) for each skill/knowledge area and for each respondent group, and for the "Importance", "Entry Skill/Knowledge Level", and

"Instruction" scales for the Local Survey instrument. The mean responses are interpreted as follows:

"Importance" Scale

$\bar{x}$ = 1.00-2.33 (not important)
$\bar{x}$ = 2.34-3.66 (moderately important)
$\bar{x}$ = 3.67-5.00 (very important)

"Entry Skill/Knowledge Level" Scale

$\bar{x}$ = 1.00-2.33 (low)
$\bar{x}$ = 2.34-3.66 (average)
$\bar{x}$ = 3.67-5.00 (high)

"Instruction" Scale

Yes
No

The directors, teachers, and coordinators indicated in all instances that basic mathematics skills and knowledge including whole numbers, fractions, decimals, percent, mixed operations, measurement and calculation, and estimation were generally very important ($\bar{x} \geq 4.50$) in T&I courses and programs. The extent of agreement was high as indicated by the standard deviations (SD < 1.00). Similarly, the local personnel generally agreed that the level of basic mathematics skills of students entering T&I programs was average. The coordinators, however, believed that students have low levels of skills and knowledge in several basic mathematics areas. Further, the directors, teachers, and coordinators individually and collectively indicated very strongly that each basic mathematics skill and knowledge area is taught in T&I programs.

The local personnel indicated that most higher order mathematics skills and knowledge areas were moderately important in T&I programs, except calculus, which had minimal importance. The standard deviations (SD > 1.00) generally suggest that there is fairly strong disagreement regarding the importance of higher order mathematics skills in T&I programs. The directors, teachers, and coordinators also reported with strong agreement that students have low levels of higher order mathematics skills. Although most higher order mathematics skills have moderate importance, there is relative disagreement within and among personnel. Further, students have low skill levels, and local personnel generally indicated that instruction does not occur in T&I programs (see Appendix E).

2. What is the degree of importance of, and what is the extent of entry student communications skills and knowledge, and are communications skills taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

The local survey respondents indicated with general agreement that communications skills including words and meanings, reading, writing, speaking, and listening were very important ($\bar{x}$ > 4.00) in T&I programs. The directors, teachers, and coordinators also tended to agree that the entry skill/knowledge levels of students were only average. However, a vast majority of local survey respondents stated

that instruction in communications skills was occurring in T&I programs.

3. What is the degree of importance of, and what is the extent of entry student interpersonal relations skills and knowledge, and are interpersonal relations skills taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

The directors, teachers, and coordinators agreed that the interpersonal relations skills of work behaviors; instructional and supervisory conversations; teamwork; and change, flexibility, and adaptability were very important ($\bar{x} > 4.40$) in T&I programs. Social conversations tended to be rated as only moderately important. The local survey personnel indicated rather consistently that the interpersonal relations skills of entry level students were only average. The great majority of directors, teachers, and coordinators also reported that all interpersonal relations skills were taught in T&I programs. Social conversations were reported to be taught by just over 50% of the respondents.

4. What is the degree of importance of, and what is the extent of entry student reasoning skills and knowledge, and are reasoning skills taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

The directors, teachers, and coordinators agreed consistently that reasoning skills including verbal reasoning, problem solving, and planning are very important ($\bar{x} > 4.00$) in T&I programs. The directors and teachers

tended to agree that the entry skill/knowledge levels of students in reasoning skills were average ($\bar{x}$ = 2.34-3.66). However, the coordinators indicated that all the reasoning skills of T&I students were low ($\bar{x}$ < 2.34). A very large majority (over 80%) of local survey respondents claimed that all reasoning skills are taught in T&I programs.

5. What is the degree of importance of, and what is the extent of entry student <u>science</u> skills and knowledge, and are science skills and knowledge taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

The directors, teachers, and coordinators indicated, with relative disagreement, that most science skills including general science, earth and atmospheric science, biology, chemistry, and physics were moderately important in T&I programs. However, the coordinators believed that general science is very important and the teachers indicated that biology is of minimum importance ($\bar{x}$ = 2.00). The respondents agreed that students' entry skill/knowledge levels in general science skills were average, however, all other science skills were low for T&I students. Further, a very large majority (approximately 75%) of the local survey respondents consistently reported that science skills and knowledge were not taught in T&I programs.

6. What is the degree of importance of, and what is the extent of entry student <u>computer technology skills and knowledge</u>, and are computer technology skills and knowledge taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

In general, the directors, teachers, and coordinators individually and collectively seemed to indicate considerable disagreement (SD > 1.00) about the importance of computer technology skills and knowledge. However, in most instances, the respondents' collective ratings indicated that computer technology skills and knowledge were moderately important in T&I programs, with the exception of programming skills, which tended to have minimal importance. There was more agreement among the directors, teachers, and coordinators that the entry skill/knowledge levels of T&I students in understanding and using terminology was average. However, the skills and knowledge of students in keyboarding, word processing, data processing, business applications, programming, and networking were low ($\bar{x}$ < 2.33). In addition, with very few exceptions, the local survey respondents noted that computer technology instruction is not occurring in T&I programs.

7. What is the degree of importance of, and what is the extent of entry student general occupational skills and knowledge, and are general occupational skills and knowledge taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

The directors, teachers, and coordinators generally agreed strongly (SD < .90) that general occupational skills such as understand and follow safety rules and procedures for materials, tools, and equipment; recognize signs and symbols in the work place; identify and determine the

correct materials, tools, and equipment needed to accomplish a task; and operate technical equipment, tools, and instruments were very highly important ($\bar{x}$ > 4.50) in T&I programs. However, the personnel agreed for the most part that the general occupational skill levels of entry T&I students were only average. The directors seemed to indicate the greatest extent of disagreement (SD > 1.00). Virtually all of the directors, teachers, and coordinators claimed that general occupational skills instruction occurred in T&I programs.

8. What is the degree of importance of, and what is the extent of entry student job - specific skills and knowledge, and are job-specific skills and knowledge taught in various T&I programs as indicated by local vocational directors, trade and industrial teachers, and industrial cooperative education coordinators?

The directors, teachers, and coordinators agreed that job-specific skills were very important ($\bar{x}$ > 4.00); however, the entry skill/knowledge levels of students were only in the average range ($\bar{x}$ > 3.00). Almost all of the local survey personnel indicated that job-specific skills instruction occurred in T&I programs.

9. What are some important new and emerging technical skill and knowledge areas (or programs and occupations) in the workplace?

The directors, teachers, and coordinators listed several new and emerging technical skill and knowledge areas in the workplace:

(19) - Computers (in general)

(9) - CAD

(8) - Robotics

(8) - Basic skills necessary for job entry levels

(6) - CNC

(5) - Electrical/electronics knowledge

(5) - Communications skills in formal settings and technical writing

(4) - Welding

(3) - Process controller or automated factory process control

(2) - Laser techniques

(1) - Hazardous waste handling

(1) - Environmental, earthquake construction

(1) - Knowledge and understanding of refrigeration, a better understanding of solid state equipment

(1) - Statistical Process Control (SPC)

10. Do effective partnerships exist between T&I programs and business, industry, and labor?

One hundred fifty-five of the local survey respondents indicated that effective partnerships existed between T&I programs and business, industry, and labor, and 48 respondents reported that partnerships did not exist. The respondents also provided some descriptions and their nature and origins:

(53) - Advisory committees including members of business and industry

(20) - Direct personal contacts with business, industry, or labor members

(16) - Program support from industry

(12) - Good job placement with industry

(11) - Cooperative programs

(4) - Partnerships in Education

(4) - Industrial cooperative training

(2) - VICA contacts

(2) - Craft committees

(2) - Partnerships exist through the area vocational school.

(1) - Our instructors work together cooperatively.

(1) - Adopt a school program (G.M.)

(1) - Surveys and studies done by companies

(1) - Schools and business establishments have become more and more isolated from each other.

(1) - Business Professionals of America

(1) - They are more informal than formal.

(1) - They exist between PIC, JTPA, and others, to fulfill the need for various professions.

(1) - Public Education Foundation

(1) - Vehicle is used in own Adult Vocational Education program and own ABE program.

11. Are there significant formal relationships existing between secondary T&I curriculum and other education content areas (e.g., mathematics, science)?

Sixty-one of the local survey respondents reported that significant formal relationships existed between secondary T&I curriculum and other education content areas, and 147 respondents noted that significant formal relationships did not exist.

(15) - Students attend formal basic math classes.

(11) - Reading, writing, and English are taught.

(9) - There should be, but aren't

(7) - No

(4) - Science classes

(3) - Academic areas do not support Vocational Education.

(2) - Only home arts classes

(2) - Interpersonal relations

(2) - The T&I classes are supported by the high school program.

(2) - Tech Prep Pilot Site

(1) - Articulation with Postsecondary, not secondary

(1) - Consumer Education, Social Studies

(1) - Job interviewing counseling, placement counseling

(1) - Through advisory committees in secondary T&I programs

(1) - We have articulation agreements for select programs with secondary institutions in our area. General education courses are required to complete certification and degrees at IVTC.

(1) - We work very closely with publications department, art department, and fine arts.

(1) - Automation resource lab

(1) - Horticulture classes

12. Are exploration programs (e.g., industrial technology/ industrial arts) coordinated with secondary T&I programs?

Eighty-one directors, teachers, and coordinators indicated that exploration programs are coordinated with secondary T&I programs, and 114 indicated that programs are not coordinated. Some respondents who claimed program

coordination provided additional comments describing the nature of program coordination:

(13) - An industrial technology course is/should be a prerequisite to help select appropriate vocation.

(6) - Industrial Arts teachers and Vocational Education teachers along with advisory committees meet to check programs.

(5) - a little bit

(4) - Instructors and students work closely with both IA & T&I.

(3) - Some have good feeder programs.

(2) - Drafting IA with CAD drafting vocational

(2) - IA teachers at the junior high level coordinate with senior high.

(1) - Occasional visitations

(1) - Equipment and supply vendors provide information on new materials and equipment, safety procedures.

(1) - Coordinated through career education, secondary education, and special education

(1) - Unit shops are available at this time.

(1) - Indiana technology programs

(1) - Through technical workshops offered through the Indiana Vocational Technical and Industrial Trade Teachers Association

(1) - Partners in Education Internship Program

13. Are secondary T&I programs articulated with postsecondary technical programs?

One hundred and four local survey respondents reported that their secondary T&I programs were articulated with postsecondary technical programs, and 92 reported that their

programs were not articulated. Personnel who reported articulation described briefly the nature of articulation:

(23) - Articulation with IVY Tech

(17) - College credits are awarded to students before they enter college.

(7) - Information is presented to students concerning postsecondary education in their areas of study.

(4) - Occupational skills

(2) - Instructors with the high school vocational directors

(2) - Only a little

(2) - Starting articulation with secondary systems

(2) - Most students are already better prepared for the job market.

(2) - Tech Prep Project

(1) - Good relationship with trade schools

(1) - Through area vocational school

(1) - We work with the military.

(1) - There should be continuity between secondary and postsecondary but there is not.

14. Are there any educational, economic, social, political, legislative, or other initiatives that have recently affected (or will affect) T&I curriculum in local programs?

One hundred and six directors, teachers, and coordinators suggested that educational, economic, social, political, legislative, or other initiatives have recently affected (or will have affected) T&I curriculum in local programs, and 69 indicated none. Some of those personnel who responded yes provided some comments:

(24) - The increased credit requirements in academic areas have reduced the electives allowed in the trade areas.

(20) - Lack of funds

(11) - Decreasing number of students due to number of hours students need in other areas

(5) - C&G rules have made it more difficult for students to take T&I programs.

(5) - Increased need for skilled tradespeople will allow for students to become involved in T&I programs.

(2) - Current job opportunities

(2) - Perkins re-authorization may effect curriculum.

(2) - Tech Prep

(2) - A new technologies grant has made it possible to purchase computers, VCR, and other "new tech" equipment.

(1) - Federal regulations on fuel mileage, and clean air

(1) - SIA perhaps

(1) - Through funding due to Carl Perkins Act, our support services live.

(1) - Under the present directions, T&I programs will probably decline in enrollment unless hands-on, meaningful projects are implemented.

15. Have increased graduation requirements affected T&I programs?

One hundred and fifty-eight local personnel claimed that increased graduation requirements have affected T&I programs, and 44 personnel indicated they have not. Personnel who responded yes commented in regard to the impact upon T&I programs:

(41) - Student count is down.

(41) - T&I programs are electives, so increasing graduation requirements lessen the opportunity for a student to take a T&I course.

(12) - Increasing graduation requirements make it difficult for T&I to attract a high quality student.

(3) - Scheduling has become a problem.

(2) - We have more students than ever.

(2) - We have a 7-period day which allows time for additional credits.

(2) - Too soon to tell

(1) - More blueprint reading and drawing

(1) - Most home school counselors are ignorant of actual requirements in relation to some college bound students and all vocational students.

(1) - Must have students finish required courses to get full amount of credits.

16. Have basic skills had an impact on T&I curriculum?

Ninety directors, teachers, and coordinators claimed that basic skills have had an impact on T&I curriculum and 101 personnel claimed that there has been no impact. Some personnel who responded yes provided some comments:

(23) - Time must be spent teaching basic skills and remediating those who are deficient in basic skills.

(20) - Many students have low levels of basic skills.

(4) - Needed to be better prepared to enter and be successful in vocational education.

(3) - Much more than just basic skills are required, i.e. mathematics, technical writing, self-supervision, teamwork, and other skill areas.

(3) - We are changing our T&I competencies to include some basic skills.

(3) - What are "basic skills"?

(1) - More academics required.

(1) - To some extent

(1) - This is my main program.

(1) - Technology advancements

(1) - More students and easy to work with

(1) - Not yet

17. In local programs, is secondary T&I curriculum regularly evaluated, updated, and revised?

A vast majority (189) of survey respondents indicated that local secondary T&I curriculum is regularly evaluated, updated, and revised. Only 14 personnel indicated this was not the case. Several respondents provided brief statements regarding procedures that were used:

(19) - Annually
(7) - Regularly
(7) - every five years
(4) - every three years
(4) - every six years
(3) - every four years
(3) - every seven years

(42) - Advisory committees, some including industry members, are used to review & update curriculum.

(25) - North Central Evaluation

(17) - Programs are revised to keep up with student and area industry needs.

(15) - Updated by the instructor

(15) - Curriculum is updated on a regular basis.

(11) - Revised by state, or to meet state requirements.

(5) - Summer workshops

(3) - Very little is done.

(3) - In House evaluations

(3) - Will be in the future

(3) - PBA

(2) - SBVTE

(2) - Working with National Code update

(2) - Follow-up study

(1) - Evaluated by Central Nine

(1) - Competency based instruction

(1) - Evaluation team makes recommendations.

(1) - Reviewed and updated by employers (duty & task listings)

(1) - ICVTE and PAC

(1) - Computerized CBI system

18. In local programs, are students who complete T&I programs formally assessed to determine if they have attained the necessary entry level skills and knowledge for the world of work?

One hundred and two directors, teachers, and coordinators reported that students who complete T&I programs are formally assessed to determine if they have attained the necessary entry level skills and knowledge for the world of work, and 92 personnel reported that no formal assessment is conducted.

(18) - Skills assessment tests

(12) - Standard competency and knowledge testing

(11) - Graduate follow-up studies

(10) - By instructor

(6) - Employment profiles reflecting what skills students have

(2) - Employers are asked to evaluate students.

(2) - Mastery Management Program

(2) - To some degree

(1) - Minimum essential tests are used.

(1) - Quality of work and quantity of work

(1) - They go to work for what they were trained.

(1) - Vocational students recognize the need to be well prepared for the world of work.

(1) - Through area vocational school

(1) - Student certificate of completion.

(1) - Formally assessed by a vocational counselor

(1) - Our advisory committee has discussed a certification that would accomplish this, but not in place at this time.

(1) - We place students in a job if they pass the course.

19. Do local programs use business, industry, and labor advisory committees?

A very large majority (191) of directors, teachers, and coordinators indicated that their local programs used business, industry, and labor advisory committees, and only 13 personnel indicated no use of advisory committees. The personnel who responded yes commented on the activities and effectiveness of the advisory committees:

<u>Are they active?</u>

(81) - Yes, they are active.

(9) - Moderately active

(7) - Some are, some aren't active.

(5) - No

(3) - Only active when needed.

How are they used?

(56) - Used to suggest and approve our curriculum and our equipment requests, offer solutions to problems, aid in decision-making, and others.

(26) - Give input on what is changing and what they require as employers (i.e. new products, new techniques)

(8) - Job placement

(2) - Meet state guidelines

(1) - Student progress evaluation

Are They Effective?

(25) - Yes

(10) - Very effective

(6) - Moderately effective

(4) - No

(2) - Most effective when problems arise

(2) - The school system generally ignores what the committee recommends.

(1) - Some are very effective, some are not.

(1) - It is only effective providing that the advisory committee members may benefit somewhat from their endeavors.

(1) - There is not enough money to do what board recommends.

20. Are employers interested in hiring a specialist?

Eighty-four of the directors, teachers, and coordinators noted that employers are interested in hiring a specialist and 69 claimed that employers are not interested in hiring a specialist. Respondents provided some comments:

What skills and knowledge level is expected?

(43) - Basic skills and knowledge of the field, entry-level skills, mathematics and communications skills

(13) - Dedicated to job, hardworking, loyal, desire to learn

(10) - Good work habits and work ethics

(9) - Good attendance

(5) - Good attitude

(5) - A higher level of skills (including technical skills)

(1) - Responsibility

21. What are additional needs and/or comments on other issues related to the current status of secondary T&I curriculum in Indiana?

The local survey respondents provided several additional comments on various issues related to the current status of secondary T&I curriculum in Indiana:

(17) - Indiana should update and increase technical education (need more money for this).

(14) - The big need is always more money.

(12) - Vocational Programs and schools need to be recognized more as a positive educational background for college bound as well as non-college bound students.

(11) - Need to have trained, knowledgeable vocational counselors and better planning for younger students.

(5) - There is no standard statewide secondary T&I curriculum in Indiana.

(4) - Lower credit requirements

(4) - Individual program areas should work jointly with other problem areas on special projects.

(3) - Concern about the inability of students to read, write, spell, or communicate verbally or by the written word

(2) - Some requirements need to be changed.

(2) - I feel too much of state monies are going to post-secondary programs.

(2) - Workshops are needed for instructors to upgrade skills, and knowledge.

(2) - Career centers should serve both secondary and post-secondary, eliminating duplication of equipment and effort such as Ivy Tech.

(1) - Much needs to be done on all levels to address a critical need.

(1) - More mechanically inclined students are needed.

(1) - Retain full responsibility for the operation of the vocational evaluation system function.

(1) - The license requirements are restricting the quality of instructors coming into T&I.

(1) - Student placement and follow-up needs to become an important factor in assisting with program accountability.

(1) - We have excellent placement of our drafting students.

(1) - If our corporation does not go to a 7-period day, then the elective areas will be a thing of the past.

(1) - Prepare students with basics.

(1) - Too many politics

National Curriculum Assessment Survey

The purpose of the National Survey was to determine the current status of secondary trade and industrial (T&I) education curriculum in each of the 50 states, District of Columbia, and six surrounding territories as perceived by state T&I supervisors. Forty-three of the 55 (78.18%) of

the state T&I supervisors returned surveys. The findings included quantitative data from the rating scale and qualitative information from the open-ended items. The reliability of the national survey is .917. The research questions and findings include:

1. Do effective partnerships exist between T&I programs and business, industry, and labor in the states?

Thirty-six of the state T&I supervisors indicated that effective partnerships existed between T&I programs and business, industry, and labor in the states, and 4 supervisors indicated that partnerships did not exist. The supervisors who responded yes provided some brief descriptions and how they have come about:

(11) - Advisory and craft committees

(10) - Business and industry leaders involved in the development of curriculum

(5) - VICA Organization

(3) - State T&I advisory committee

(3) - Personal contact between teachers or administrators and association trade groups and industry

(2) - Business, Industry Education alliance (BIE)

(2) - Not a unified effort/plan on a statewide basis

(1) - Student organization activities

(1) - KIT projects

(1) - The Division of Occupational Education has developed a manual and provides technical assistance on advisory committees.

(1) - Machinists association, printing industry offers workshops to teachers.

(1) - Program evaluations

(1) - Adopt-A-School Program

2. Are there formal relationships existing between secondary T&I curriculum and other education content areas (e.g., mathematics, science)?

Nineteen of the state T&I supervisors reported that there are formal relationships existing between secondary T&I curriculum and other education areas, and 19 supervisors reported that formal relationships did not exist. Some of the supervisors provided brief descriptions:

(14) - Applied math

(9) - Principles of Technology

(7) - Science programs

(6) - Applied communications

(3) - There are some developing

(2) - Program options are funded by Vocational Education and content determined by vocational teacher consulting with academic teacher.

(2) - CORD

(1) - Competency-Based Vocational Education (CBVE) model

(1) - Options available for students to combine T&I instruction with other occupational education subjects to meet graduation requirements

(1) - Several Trade areas have been identified as meeting the basic skills requirements in high school and have been approved by the state board as such.

(1) - A pilot program integrating curriculum at the vocational technical high school

(1) - We have a course requiring programs now underway that establishes a full program for high school students, not just T&I courses available.

(1) - Video production and language arts - on district basis

3. Are exploration programs (e.g., industrial technology/ industrial arts) coordinated with secondary T&I programs?

Twenty-three of the state T&I supervisors claimed that exploration programs are coordinated with secondary T&I programs and 14 supervisors claimed that programs are not coordinated. Several supervisors who responded yes described briefly the nature of the articulation:

(6) - Efforts are being made.

(2) - To some extent

(2) - Currently developing and exploring industrial technology education program; soliciting industry input for curriculum

(1) - In many cases instructors teach IA & VT courses

(1) - Task Force ensures the coordination of exploring programs and industrial technology programs with secondary vocational programs.

(1) - Exploration program areas generally cover areas offered at the secondary level.

(1) - Not directly - IA state staff incorporated in vocational education meetings - programs are <u>not</u> prerequisite.

(1) - Programs are planned around complete course sequences from 9th - 12th grade and possibly community college.

(1) - In various degrees - some identity crisis exists in IA/Technology education.

(1) - Industrial arts serves as feeder program to T&I areas.

(1) - Yes, we have diversified technology in the larger centers.

(1) - Through intra-service agreement, students completing an articulated technology program may enter level II of T&I.

(1) - Philosophy of comprehensive high school

(1) - Total program concepts

(1) - State staff coordination; joint staff development in select areas for T&I and IA

(1) - We have incorporated some "Principles of Technology" in our curriculum; technology Education is an exploratory program but not a part of T&I.

(1) - Pre-vocational programs at the area vocational technical centers

(1) - Have approved program lists.

4. Is secondary T&I curriculum articulated with postsecondary T&I curriculum?

Approximately 75% (27) of the state T&I supervisors indicated that secondary T&I curriculum was articulated with postsecondary T&I curriculum, and 11 supervisors indicated that curriculum is not articulated. Several supervisors who responded yes described briefly or commented on the nature of the articulation:

(10) - 2 + 2 programs in several areas

(9) - On a limited basis

(6) - Some local systems have articulation agreements with postsecondary

(4) - Programs are in a developmental stage

(3) - Not official statewide policy

(3) - I wish it was.

(2) - College credit for courses taken at the secondary level

(1) - Done on a district level

(1) - Offer a one year curriculum program for our post-secondary students.

(1) - This is accomplished through legislated concurrent enrollment programs.

(1) - Video production

5. Are there any educational, economic, social, political, legislative, or other initiatives that have recently affected (or will affect) T&I curriculum in the states?

Eighty percent (32) of the state T&I supervisors reported that educational, economic, social, political, legislative, or other initiatives have recently affected (or will affect) T&I curriculum in the states, and 8 supervisors reported that there has been no affect. Some supervisors provided comments about the affects:

(7) - Educational Reform Act has added graduation requirements, limiting electives.

(5) - Educational Reform Act has brought on the reforming of the curriculum.

(2) - The entire education system is under restructuring - revision.

(2) - We fund based on how many jobs there are; this hurts T&I greatly.

(2) - Constant

(1) - Working to receive NATEF Certification and AGC recognition

(1) - Implemented a "Business and Industry" program in which the course materials meet the specific needs of local industries

(1) - A technology education course of study (34 learning objectives) will be mandated for all 7th and 8th grade students.

(1) - All secondary graduates by 1993 must be prepared for employment and/or postsecondary education.

(1) - Re-authorization of Vocational Education Act remains in question.

(1) - We have legislation and funding that is currently effecting partnerships with industry, economic development, and education.

(1) - Legislature passed a 6 million dollar allocation for vocational equipment.

(1) - Competency-based education is mandated.

(1) - New required 7 period day will help this situation (reduced enrollment) to a degree.

(1) - Funding was placed on a FTE basis that reduced the categorical funding for T&I.

(1) - Our legislative body understands vocational education.

(1) - Potential changes to the Perkins Act

6. Have states recently increased graduation requirements?

About 85% (32) of the state T&I supervisors noted that their states had recently increased graduation requirements, and 7 supervisors noted no increase. Several of the supervisors described or commented on the impact upon T&I programs:

(19) - Fewer students are able to schedule classes due to less time for electives, causing lower enrollment.

(3) - Developed a more flexible program structure and applied/related courses to meet graduation requirements

(2) - It has not detracted from vocational course offerings.

(1) - Mostly what it hurt was IA which were feeder courses to T&I.

(1) - Vocational education counteracted with "Program Options" issuing credit in order that students could still participate in vocational education.

(1) - New state legislation will probably expand options to all programs.

(1) - High schools are holding students back for various reasons.

(1) - Educators complained that they did not get students with appropriate skills.

(1) - Some see great impact others see little change.

(1) - New QBE law did increase requirements.

(1) - 3 years ago

7. Have basic skills had an impact on T&I curriculum in the states?

Thirty-six state T&I supervisors claimed that basic skills have had an impact on T&I curriculum in their states, and 4 claimed that there was no impact. Several supervisors described or commented on the impact:

(10) - Instructors are emphasizing and including basic and employability skills.

(4) - More mathematics and science has been required (e.g., Principles of Technology) for graduation.

(3) - We are in planning stages.

(2) - State Board of Education is getting ready to grant academic credit where basic skills are taught in vocational education.

(2) - Low Mathematics and reading skills of students

(2) - Workshops are designed to assist instructors to develop lesson plans to reinforce basic skills as an integral part of the curriculum.

(1) - The state has a program to improve basic skills of disadvantaged T&I students.

(1) - We have implemented competency based profiles.

(1) - Initiated dialogue for integrating these skills into T&I programs and being able to substantiate their inclusion for possible credit towards graduation

(1) - Graduates lacking these have spawned a host of study committees.

(1) - Not on an official organized basis

8. Is statewide competency/achievement testing having an impact on secondary T&I programs in the states?

Less than one-half (15) of the state T&I supervisors indicated that statewide competency/achievement testing was having an impact on secondary T&I programs in their states, and 21 supervisors indicated that there was no impact. Several supervisors who responded there was an impact provided brief explanations or comments:

(4) - Programs must test for competency

(2) - Several schools have set in place total competency programs; the teacher has become more of a manager and has students at many different learning levels.

(2) - We have none.

(2) - Students have access to assessment centers.

(2) - It has caused us to place mandated standardized CORE objectives into the curriculum of each T&I program.

(2) - Still need work in this area

(1) - Received grants to implement competency testing

9. Do secondary T&I programs receive adequate funds and sufficient resources (e.g., materials, equipment)?

Approximately 80% (31) of the state T&I supervisors reported that secondary T&I programs did not receive adequate funds and sufficient resources, and 6 supervisors reported that adequate funds and sufficient resources were received. Many supervisors suggested what was needed:

(27) - Funds are needed for equipment and curriculum development.

(2) - A systematized regular program of equipment replacement is needed.

(1) - Secondary school administrators need to be better prepared and organized.

(1) - CPA funds are used.

(1) - We are working for full funding of the vocational add factor this year in the legislature.

10. In the states, are there currently any initiatives or changes in the certification requirements or patterns for secondary T&I education instructors, or, are any anticipated?

Approximately one-half (19) of the state T&I supervisors reported current or anticipated initiatives or changes in the certification requirements or patterns for secondary T&I education instructors, and 21 supervisors reported no current or anticipated initiatives or changes. Some supervisors provided brief comments regarding certification requirements and patterns and any pending changes:

(9) - These are under revision.

(2) - The new certification requirements establish a B.A. for our new teacher certification plus the specialization.

(1) - Let any Industry person in who can pass a competency test.

(1) - B.E. & degree required, 3600 hours of journeyman work experience is required.

(1) - All teachers have the same coursework for initial certification.

(1) - Plan to go from 1 year enrollment to 3 year.

(1) - Required college credits may double from 18 to 36.

(1) - 15 semester hours of methodological coursework in education and 5 years work experience or 2 years work experience and a graduate of a certified program, an associate or bachelor program

(1) - Trade exam and 18 hours in 5 years; new requirements have been promoted; little response from state department of education.

(1) - B.S. degree plus 2000 hours related occupational experience - must renew license every 5 years

(1) - 5 years work experience; acquisition of bachelors degree

(1) - New certification regulations adopted July 89 for all educational areas

11. Is secondary T&I curriculum regularly evaluated, updated, and revised?

Over 80% (32) of the state T&I supervisors claimed that their states' secondary T&I curriculum was regularly evaluated, updated, and revised, and 6 state supervisors claimed that secondary T&I curriculum was not regularly evaluated, updated, and revised. Several supervisors described briefly the procedures used, or, explained why procedures were not used:

(5) - Coordinate program with teachers from the different courses and industry so as to keep our curriculum updated

(4) - Periodic updating by teams of teachers

(4) - On-site visit evaluation

(3) - State program standards

(2) - Rotation cycle for all materials to match textbook committee schedules

(2) - Reviewed by state staff

(2) - Follow-up is used after evaluation.

(1) - Do not have the personnel to keep it up to date

(1) - Curriculum is now being updated and revised - but we do not have a regular program of revision.

(1) - Craft committee input

(1) - Based on periodic vocational needs assessments done by the local district then looked at every 3 years during the accreditation process

(1) - Implementing a 3-year cycle update

(1) - Developing a new delivery system and a new evaluation system for vocational education

(1) - 20% of schools every year, federal regulations

(1) - Local occupational advisory committee for the respective training program

(1) - Currently in the process of complete evaluation, update and revision

(1) - Self-evaluation

- Update/Evaluation occurs:

(9) - every 5 years
(6) - annually
(3) - every three years
(2) - every four years
(1) - every two years
(1) - continually

12. Are there any secondary trade and industrial education curriculum evaluation and development/revision activities currently underway?

Twenty-four of the state T&I supervisors noted that in their states secondary trade and industrial education curriculum evaluation and development/revision activities were underway, and 15 supervisors noted that no activities

were underway. Some supervisors described or listed any new or emerging programs:

(9) - T&I areas are currently undergoing updating and revision.

(3) - Building construction

(2) - No

(2) - Auto Mechanics

(2) - Computer curriculum

(2) - Drafting - Graphic Arts/Printing-Welding, Auto Body repair are all at different stages of curriculum development.

(1) - Requires 5-year rotation approval (use criteria); in addition - Task Analysis/Curriculum Guides and others for major areas revised on a regular basis; currently doing medical assisting and machine trades

(1) - In industrial education we revised curriculum for 14 program areas 1988-1989; for 13 areas 1989-1990.

(1) - Robotics

(1) - CAD has been incorporated into the drafting curriculum. The Vehicle and Mobile Equipment Mechanics programs are relatively new in the state and proving successful; just established a Furniture Manufacturing Technology program.

(1) - Electronics, Industrial Maintenance, Facility Maintenance

(1) - Marine trades

13. Are the knowledge and skills acquired in currently offered T&I programs consistent with the present or future employment and training needs of the world of work?

Two-thirds (24) of the state T&I supervisors perceived and 12 supervisors did not perceive that the knowledge and

skills acquired in currently offered T&I programs were consistent with the present or future employment and training needs of the world of work. Those supervisors who did not perceive consistency between skills acquired in present T&I programs and the present and future employment and training needs of the world of work offered several explanations:

(10) - Present courses need to be updated in order to meet the high-tech knowledge needs of employers.

(8) - Basic and academic skills must become a vital part of T&I programs.

(3) - Out-dated teachers

(2) - Much work is needed.

(1) - Lack of support from local schools, misunderstanding by the general public of what vocational education is and can do for the future of this country.

(1) - With help from Advisory Committees and CBVE, our Vocational Education program is truly state of the art, and is monitored annually.

(1) - Yes, at the secondary level

(1) - Industry input indicates current adequacy of materials.

(1) - According to VA Employment Communication statistics, 74% of workers surveyed get their training in secondary T&I.

(1) - In general, schools that are not effectively using local advisory committees may be out of touch with the real world.

(1) - A great amount of change in course content has taken place in the last five years.

14. Are students who complete T&I programs formally assessed to determine if they have attained the necessary entry level skills and knowledge for the world of work?

Less than one-third (12) of the state T&I supervisors indicated that their states formally assessed students who complete T&I programs to determine if they have attained the necessary entry level skills and knowledge for the world of work, and 26 state supervisors indicated that their states did not formally assess students. Those state supervisors who responded yes briefly commented or described the procedures used:

(5) - Student profile charts are maintained which show the competencies attained.

(3) - Not on a statewide basis

(2) - Not formally; some individual instructors/districts may test.

(2) - The only true assessment can be made by the employers who hire the student.

(2) - In the future, each student will leave T&I programs with a record of the CORE objectives obtained.

(1) - Statewide performance tests for completers are under development for each program.

15. In the states, are advisory committees that include business, industry, and labor personnel actively involved in secondary T&I curriculum updating and revision activities?

Approximately 88% (35) of the state T&I supervisors claimed that in their states advisory committees that include business, industry, and labor personnel were actively involved in secondary T&I curriculum updating and

revision activities, and 5 supervisors claimed that advisory committees were not involved. Several supervisors commented or described the kinds of involvement:

(18) - Advisory committees advise, and update and revise curriculum, equipment and make recommendations at the local and state level.

(6) - Updating process links a teacher and a representative of industry in a one to one, side by side, review of skills needed for their industry. Teachers and industry collaborate.

(4) - At the local level

(3) - To some extent

(2) - We do have active advisory committees but I don't have enough information to describe them.

(1) - At the state level

(1) - Through worker task lists

(1) - They provide teachers with technical updates and assist with supplies, personnel, and dollars for VICA contest programs.

(1) - Business and Industry personnel make up our review team for task updates.

(1) - Organized labor is rarely involved.

(1) - Done at state level on a needs basis

16. Are employers interested in hiring a specialist?

Thirteen of the state T&I supervisors indicated that employers were interested in hiring a specialist and 12 supervisors indicated that employers were not interested in hiring a specialist. Several supervisors provided additional comments regarding hiring a generalist and

perspectives of employers' expectations of skills and knowledge for students:

Level of Skills and Knowledge

(9) - Basic skills and work ethic
(8) - Entry level hands-on skills, employability skills in communications, getting along with people, and others
(4) - Mathematics
(3) - Knowledge to read, write, and spell
(3) - Usually expect more than can be obtained in secondary programs; most do not understand the levels and programs at this level.
(2) - Analytical and technical skills
(1) - Minimum occupational competencies
(1) - Science

17. What are additional needs and/or comments on other issues, or needed major curriculum changes related to the current status of secondary T&I curriculum in the states?

Some state T&I supervisors commented on additional needs, issues, or needed major curriculum changes related to the current status of secondary T&I curriculum in their states:

(4) - More electives and new course offerings must be made available.

(3) - Increased funding to support programs

(2) - Continued effort to involve business and industry needed

(2) - Remove turf-select a system and accept responsibility for a portion and keep it all current.

(1) - We need a better method of "marketing" the programs. We have quality teachers, good classrooms; industry needs employees but our enrollments are dropping!

(1) - We need for other educators to stop viewing our programs as a dumping ground.

(1) - Need for staff development and inservice of existing vocational educators - new content and instructional methodologies require this.

(1) - Drop those programs that prepare for minimum wage jobs or limit their enrollments. If T&I can't prepare for meaningful jobs they should get out of business under the leadership of personnel from other vocational areas whose goals were never to prepare students for meaningful occupations.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The conclusions are drawn from the findings of this study. The conclusions are organized around the 3 surveys and include:

Business, Industry, and Labor Curriculum Needs Survey

1. Basic mathematics skills that include whole numbers, fractions, decimals, percent, mixed operations, measurement and calculation, and estimation are very important; however, higher order mathematics skills have only minimum to moderate importance in companies. The entry employee skills in basic mathematics are average, and in higher order mathematics are low.

2. Communications skills such as words and meanings, reading, writing, speaking, and listening are very important in companies. However, the communications skills of entry employees are average.

3. Interpersonal relations skills that include work behaviors; instructional and supervisory conversations; teamwork; and change, flexibility, and adaptability skills are very important, and social conversations skills are moderately important in companies. However, the entry level skills of employees are only average.

4. Reasoning skills such as verbal reasoning, problem solving, and planning are very important in companies, however, the skills of entry employees are only average.

5. In general, science knowledge (or skills) in areas of earth and atmospheric science, biology, chemistry, and physics have minimal importance, and general science knowledge has minimal to moderate importance in companies. However, there is disagreement among personnel about importance which suggests that the relative importance of science skills in various companies is likely related to individual occupations or jobs some for which science knowledge may be very important. The general science knowledge of entry level employees is average; however, knowledge in all other science areas is commonly low.

6. Overall, computer technology skills and knowledge that include understand and use terminology, keyboarding, word processing, data processing, business applications, programming, and networking are moderately important in companies. However, relative disagreement among personnel suggest that skill/knowledge importance is specific to individual occupations or jobs. In general, the skills and knowledge of entry level employees are low to average, however, there is apparent disparity among personnel regarding the actual skills or knowledge of employees.

7. General occupational skills such as understand and follow safety rules and procedures for materials, tools, and equipment; recognize signs and symbols in the workplace; identify and determine the correct materials, tools, and equipment needed to accomplish a task; and operate technical equipment, tools, and instruments are very important in companies. The skills and knowledge of entry employees, however, are only average.

8. Job-specific skills and knowledge are very important in companies; however, the entry level skills and knowledge of employees are only average.

9. Computer, electronics, CAD/CAM, robotics, and laser related programs are the most common new and emerging technical skill and knowledge areas or occupations in the workplace.

10. Employers prefer to hire a generalist, however, a specialist is still in demand.

11. Business, industry, and labor need to increasingly develop partnerships with secondary school trade and industrial education programs.

12. Ongoing, adequate, quality, and effective trade and industrial education curriculum that is responsive to continuous change in the labor market can be assured by involving business and industry more directly to more clearly understand their needs, and by monitoring the labor market and providing programs accordingly.

13. Most companies (75%) are involved in advisory committees and most (80%) of those companies have productive experiences.

14. Labor union personnel are underrepresented in local secondary trade and industrial education advisory committees.

Local Curriculum Assessment Survey

1. Basic mathematics skills that include whole numbers, fractions, decimals, percent, mixed operations, measurement and calculation, and estimation are very important; however, higher order mathematics skills have moderate importance, except for calculus which has low importance in secondary trade and industrial education programs. There is somewhat strong disagreement among T&I personnel which suggests that the relative importance of higher order mathematics skills and knowledge is specific to individual programs. Entry level students have average basic mathematics and low higher order mathematic skills and knowledge, although, coordinators tend to view students' basic mathematics skills as low. All basic mathematics skills are claimed to be taught and higher order mathematics skills are claimed not to be taught in T&I programs.

2. Communications skills such as words and meanings, reading, writing, speaking, and listening are very important in T&I programs. However, the skills and knowledge of entry students are only average. Instruction is reported to occur in T&I programs.

3. Interpersonal relations skills including work behaviors; instructional and supervisory conversations; teamwork; and change, flexibility, and adaptability skills are very important and social conversations are moderately important in T&I programs, however, the entry level skills of students are only average. Instruction is claimed to occur in programs.

4. Reasoning skills (verbal reasoning, problem solving, planning) are very important in T&I programs, however, students' entry level skills are low to average. Personnel report that all reasoning skills are taught in T&I programs.

5. Overall, science knowledge in areas of general science, earth and atmospheric science, biology, chemistry, and physics are moderately important in T&I programs. However, there is disagreement among personnel regarding the extent of importance, which suggests that the importance of science knowledge is relative to individual programs. The entry level knowledge of students in general science is average; however, is low in all other science areas. Science knowledge and skills, in general, are apparently not taught in T&I programs.

6. There is considerable disagreement among personnel with respect to the (moderate) importance of computer technology skills and knowledge in understanding and using terminology, keyboarding, word processing, data processing, business applications, programming, and networking. The degree of importance of these skills is specific to different programs. Entry level students possess average knowledge of understanding and using terminology, however, all other skills are low. With few exceptions, computer technology skills and knowledge instruction seemingly does not occur in secondary T&I programs.

7. General occupational skills that include understand and follow safety rules and procedures for materials, tools and equipment; recognize signs and symbols in the workplace; identify and determine the correct materials, tools and equipment needed to accomplish a task; and operate technical equipment, tools, and instruments are very highly important in secondary T&I programs. The entry level skills and knowledge of students, however, are only average. Secondary T&I programs provide instruction in general occupational skills and knowledge.

8. Job-specific skills and knowledge are very important in T&I programs, the entry skill levels of students are average, and job-specific instruction occurs in secondary T&I programs.

9. Computer, CAD/CAM, CNC, and robotics related programs are the new and emerging technical skill and knowledge areas, or programs and occupations in the workplace.

10. Effective partnerships appear to exist between secondary T&I programs and business, industry, and labor while advisory committees include members of business and industry, and, to a lesser extent, labor.

11. In general, significant formal relationships between secondary T&I curriculum and other education content areas (e.g., mathematics, science) apparently do not exist.

12. In most cases, exploration programs such as industrial technology and industrial arts are not coordinated with secondary T&I programs.

13. Slightly more than one-half of secondary T&I programs are articulated with postsecondary technical programs.

14. Educational, economic, social, political, legislative, or other initiatives have recently affected or will affect secondary T&I curricula in local T&I programs; for example, the effect of increased graduation requirements and funding.

15. Increased graduation requirements have affected secondary T&I programs (almost 80%) and have been manifested in declining enrollments.

16. Basic skills have had an impact on curriculum in approximately one-half of secondary T&I programs, and the effect has been, in some cases, that T&I program personnel have begun to teach basic skills to students.

17. Secondary T&I curriculum is reported to be regularly evaluated, updated, and revised at the local level, for the most part, using various methods which include advisory committees.

18. Slightly more than one-half of secondary T&I programs claim to formally assess students who complete programs to determine if they have attained the necessary entry level skills and knowledge for the world of work.

19. Almost all local T&I programs use business, industry, and labor advisory committees, and the committees appear to be active.

20. Employers prefer to hire specialists rather than generalists according to a slight majority of secondary T&I personnel.

National Curriculum Assessment Survey

1. Almost all states have reported effective partnerships existing between T&I programs and business, industry, and labor, which frequently result in advisory committee involvement in curriculum development.

2. A slight majority of states have formal relationships existing between secondary T&I curriculum and other education content areas such as mathematics and science, and these relationships often result in applied mathematics and communications, science, and Principles of Technology instruction.

3. In general, several states coordinate secondary exploration programs such as industrial technology and industrial arts with secondary T&I programs; however, the coordination does not seem well described or systematized.

4. A large majority of states articulate secondary T&I curriculum with postsecondary technical curriculum and they frequently take the form of 2+2 programs and interagency agreements.

5. Most states have had or will have had educational, economic, social, political, legislative, or other initiatives affect T&I curriculum in areas such as changing graduation requirements and curriculum reform.

6. The vast majority of states have recently increased their graduation requirements which has often resulted in declining enrollments in secondary T&I programs.

7. The large majority of states have had basic skills make an impact on T&I curriculum, and this has frequently resulted in T&I personnel emphasizing basic and employability skills, mathematics, and science skills in their instruction.

8. Statewide competency/achievement testing has not had an impact on secondary T&I programs in a slight majority of states.

9. Secondary T&I programs do not receive adequate funds and sufficient resources in a very large majority (80%) of states, and funds are especially needed for equipment and curriculum development.

10. There are or will be initiatives or changes in the certification requirements or patterns for secondary T&I education instructors in approximately 50% of the states.

11. A very large majority (80%) of states claim to regularly evaluate, update, and revise secondary T&I curriculum; however, the methods and procedures are not clearly described nor necessarily systematized.

12. Most states reportedly have secondary T&I education curriculum evaluation and development/revision activities currently underway; however, the nature of these activities and (systematic) procedures are unclear.

13. In general, states perceive that the knowledge and skills acquired in currently offered secondary T&I programs are consistent with the present or future employment and training needs of the world of work. However, in many instances programs need updating and basic academic skills need to be integrated into T&I programs.

14. Most states do not formally assess students who complete T&I programs to determine if they have attained the necessary entry level skills and knowledge for the world of work.

15. Almost all states have advisory committees that include business, industry, and labor personnel actively involved in secondary T&I curriculum updating and revision activities, and the advisory committees frequently assist in making curriculum and equipment recommendations.

16. Employers prefer to hire specialists rather than generalists in a slight majority of states.

Recommendations

The recommendations are offered based on the results of this study. The recommendations include:

1. Because basic mathematics skills that include whole numbers, fractions, decimals, percent, mixed operations, measurement and calculation, and estimation are very important in secondary trade and industrial education programs and in the workplace, they should be included in all T&I curriculum and should be integrated in T&I program instruction. Higher order mathematics skills should be integrated into T&I curriculum and instruction in those programs (and occupations) that require them.

2. Communications skills such as words and meanings, reading, writing, speaking and listening are very important in T&I programs and in the workplace and, therefore, should be included in secondary T&I curriculum and taught in programs.

3. Interpersonal relations skills (work behaviors, instructional and supervisory conversations, teamwork; and change, flexibility, and adaptability) are very important in T&I programs and occupations and should be integrated into T&I curriculum and instruction.

4. Reasoning skills including verbal reasoning, problem solving, and planning are very important in T&I programs and companies and, therefore, should be part of T&I curriculum and instruction.

5. Science knowledge (or skills) should be integrated into the curriculum and instruction of those individual T&I programs and occupations that require them.

6. Computer technology skills and knowledge such as understanding and using terminology, keyboarding, word processing, data processing, business applications, programming, and networking should be integrated into the curriculum and instruction of the individual programs and workplace environments which require them.

7. General occupational skills and knowledge such as understand and follow safety rules and procedures for materials, tools, and equipment; recognize signs and symbols in the workplace; identify and determine the correct materials, tools, and equipment needed to accomplish a task; and operate technical equipment, tools, and instruments are very highly important in secondary T&I education programs and in the workplace and, therefore, should be continued or integrated in T&I curriculum and instruction.

8. Job-specific skills are very important in T&I programs and in the workplace and should continue to be an emphasis of secondary T&I education curriculum.

9. Secondary T&I education curriculum should focus curriculum activities in new and emerging technical areas identified in the world of work such as computer, electronics, CAD/CAM, CNC, robotics, pneumatics, hydraulics, and laser related programs/occupations.

10. Curriculum should increasingly emphasize general occupational knowledge and skills while retaining those necessary job-specific components to adequately meet the needs of the labor market.

11. Secondary T&I programs should strengthen or initiate productive partnerships with business, industry, and labor. Partnerships should include active (general and program) advisory committees that include adequate representation from labor. Activities could focus on curriculum evaluation and materials, tools, equipment, and facilities recommendations. Partnerships can help ensure ongoing, adequate, quality, and effective secondary T&I education programs that are responsive to continuous change in the labor market.

12. Since several basic, applied, and employability skill areas are very important in T&I programs and occupations, T&I personnel need to develop formal relationships with other education content areas such as mathematics, reading, and science. For instance, relationships could delineate the ways in which assessment, instruction, evaluation, or remediation could be provided to students (e.g., collaboratively) who are enrolled in T&I programs and having difficulty with those applied academics that are necessary in T&I

programs. Formal relationships can also serve as a starting point to identify solutions to problems and issues affecting T&I programs and education programs in general (e.g., increased graduation requirements, declining enrollment, student competency/achievement testing, funding).

13. Vocational education personnel should strongly consider coordinating secondary exploration programs (e.g., industrial technology education/industrial arts) with secondary T&I education programs and with post-secondary technical programs, (e.g., 2+2 programs, TECH PREP, interagency agreements). Coordination would expand options and would assist students in making informed career development and transition decisions, and would help reduce the potential duplication of program activities.

14. Local T&I programs should systematically and formally assess students who complete programs to determine if they have attained the necessary entry level skills and knowledge for the workplace. Formative and summative student assessment should be a major focus in local program evaluations.

15. Local T&I programs need to receive additional sources of funds and other resources to effectively deliver programs and to adequately prepare the student for employment or postsecondary education. Increasing state and local revenues are needed for T&I program expansion and improvement.

16. Policymakers, T&I personnel, and other necessary personnel should work closely on matters of curriculum and certification requirements or patterns to ensure that personnel are adequately prepared to teach in T&I programs.

17. The role of vocational education, and, more specifically, secondary trade and industrial education, needs to be more effectively communicated with respect to its goals, curriculum, and instruction.

18. The terms "basic skills", "basic academic skills", "applied academics", and other commonly used terms need to be defined operationally in vocational and T&I programs. This study has identified several skills and knowledge areas that are generic and, therefore, "basic" within and across secondary T&I programs. These skill and knowledge areas need to be further communicated, described, and disseminated within the context of T&I programs and for the occupations in which students are preparing to enter. In addition,

the relationship between these generic skills and knowledge areas and other education content areas needs to be further delineated.

19. Preservice, inservice, and graduate education programs should include the concepts, skills, and knowledge identified in this curriculum study to improve the preparation of vocational and T&I teachers.

20. Secondary T&I personnel must strongly consider and implement the suggestions and recommendations from business, industry, and labor in local curriculum evaluation activities.

21. Since the generic skills identified in this study are, in fact, a concern of education in general (i.e., K-12), long-term solutions will require enfranchisement of and input from educators in all disciplines.

22. A study needs to be conducted to develop curriculum standards and identify proficiencies for each (and all) secondary T&I education programs.

23. Major curriculum development activities should be conducted. After establishing curriculum standards and proficiencies, each (and all) secondary T&I education program/course should undergo systematic and comprehensive curriculum development. Existing programs should be revised appropriately, and new programs should be developed as would be necessary.

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APPENDICES

Appendix A

Business, Industry, and Labor (BIL) Curriculum Needs Survey

Business, Industry, and Labor Curriculum Needs Survey

Secondary Trade and Industrial Education

The purpose of this survey is to determine the current and projected secondary school vocational trade and industrial education curriculum needs in the state of Indiana as perceived by business, industry, and labor personnel. This survey contains 2 parts: Part I and Part II. Part I includes items and a rating scale. Part II includes open-ended questions. Complete the survey by following the directions for each part and providing your responses accordingly.

Target Population You Represent (check one):

___ Labor Union Representative
___ Management
___ Proprietor
___ Other (please specify: _____)

Types of trade and industrial occupations/workers involved in your company (check all that apply):

___ Air Conditioning
___ Appliance Repair
___ Auto Body
___ Auto Mechanics
___ Aviation
___ Barbering
___ Business Machine Maintenance
___ Cabinet Making
___ Commercial Art
___ Commercial Fishery
___ Commercial Photography
___ Construction & Maintenance
___ Cosmetology
___ Custodial Service
___ Diesel Mechanics
___ Drafting
___ Dry Cleaning
___ Electrical
___ Electronics
___ Foremanship, Supervision, & Management Development
___ Furniture Making
___ Graphic Arts/Printing
___ Industrial Atomic Energy
___ Instrument Maintenance and Repair
___ Leather Working
___ Machine Shop
___ Maritime
___ Metal Fabrication
___ Metallurgy
___ Plastics
___ Precision food production
___ Public Service
___ Small Engine Repair
___ Stationary Energy Sources
___ Textile Production and Fabrication
___ Upholstering
___ Welding and Cutting
___ Other (please specify)
_____
_____
_____
_____

Part I

The purpose of Part I of this survey is to determine (a) how important various skills and knowledge are with respect to your company, and (b) the level of skills of individuals entering your company.

Directions: Indicate, by circling the number, the degree of importance and level of employee skills and knowledge for each of the skill/knowledge areas listed below.

Skill/Knowledge Area	Importance in Your Company					Entry Employee Skill/Knowledge Level					
Mathematics	Not Important		Moderately Important		Very Important	Don't Know	Very Low	Low	Average	High	Very High
Basic											
Whole Numbers	1	2	3	4	5	DK	1	2	3	4	5
Fractions	1	2	3	4	5	DK	1	2	3	4	5
Decimals	1	2	3	4	5	DK	1	2	3	4	5
Percent	1	2	3	4	5	DK	1	2	3	4	5
Mixed Operations	1	2	3	4	5	DK	1	2	3	4	5
Measurement and Calculation	1	2	3	4	5	DK	1	2	3	4	5
Estimation	1	2	3	4	5	DK	1	2	3	4	5
Higher Order											
Algebra	1	2	3	4	5	DK	1	2	3	4	5
Geometry	1	2	3	4	5	DK	1	2	3	4	5
Trigonometry	1	2	3	4	5	DK	1	2	3	4	5
Calculus	1	2	3	4	5	DK	1	2	3	4	5

Skill/Knowledge Area	Importance in Your Company					Entry Employee Skill/Knowledge Level					
	Not Important		Moderately Important		Very Important	Don't Know	Very Low	Low	Average	High	Very High
Communications											
Words and Meanings	1	2	3	4	5	DK	1	2	3	4	5
Reading	1	2	3	4	5	DK	1	2	3	4	5
Writing	1	2	3	4	5	DK	1	2	3	4	5
Speaking	1	2	3	4	5	DK	1	2	3	4	5
Listening	1	2	3	4	5	DK	1	2	3	4	5
Interpersonal Relations											
Work Behaviors	1	2	3	4	5	DK	1	2	3	4	5
Instructional and Supervisory Conversations	1	2	3	4	5	DK	1	2	3	4	5
Social Conversations	1	2	3	4	5	DK	1	2	3	4	5
Teamwork	1	2	3	4	5	DK	1	2	3	4	5
Change, Flexibility, and Adaptability Skills	1	2	3	4	5	DK	1	2	3	4	5
Reasoning											
Verbal Reasoning	1	2	3	4	5	DK	1	2	3	4	5
Problem Solving	1	2	3	4	5	DK	1	2	3	4	5
Planning	1	2	3	4	5	DK	1	2	3	4	5

Skill/Knowledge Area	Importance in Your Company					Entry Employee Skill/Knowledge Level					
Science	Not Important		Moderately Important		Very Important	Don't Know	Very Low	Low	Average	High	Very High
General Science	1	2	3	4	5	DK	1	2	3	4	5
Earth and Atmospheric Science	1	2	3	4	5	DK	1	2	3	4	5
Biology	1	2	3	4	5	DK	1	2	3	4	5
Chemistry	1	2	3	4	5	DK	1	2	3	4	5
Physics	1	2	3	4	5	DK	1	2	3	4	5
Computer Technology											
Understand and use terminology	1	2	3	4	5	DK	1	2	3	4	5
Keyboarding	1	2	3	4	5	DK	1	2	3	4	5
Word processing	1	2	3	4	5	DK	1	2	3	4	5
Data processing	1	2	3	4	5	DK	1	2	3	4	5
Business applications	1	2	3	4	5	DK	1	2	3	4	5
Programming	1	2	3	4	5	DK	1	2	3	4	5
Networking	1	2	3	4	5	DK	1	2	3	4	5

Skill/Knowledge Area	Importance in Your Company					Entry Employee Skill/Knowledge Level					
General Occupational Skills	Not Important		Moderately Important		Very Important	Don't Know	Very Low	Low	Average	High	Very High
Understand and follow safety rules and procedures for materials, tools, and equipment.	1	2	3	4	5	DK	1	2	3	4	5
Recognize signs and symbols in the workplace.	1	2	3	4	5	DK	1	2	3	4	5
Identify and determine the correct materials, tools, and equipment needed to accomplish a task.	1	2	3	4	5	DK	1	2	3	4	5
Operate technical equipment, tools, and instruments.	1	2	3	4	5	DK	1	2	3	4	5
Job - Specific Skills (i.e. those technical skills that are unique to a given job or occupation)(e.g., heating and air conditioning, auto mechanics, carpentry, electronics, machine shop, welding, graphic arts)	1	2	3	4	5	DK	1	2	3	4	5

What are some important new and emerging technical skill and knowledge areas (or occupations) in the workplace (include any skills or knowledge areas not listed above)?

Part II

The purpose of Part II of this survey is to obtain information regarding several curriculum issues and business, industry, and labor needs.

Directions: You may respond to any of the following items, if appropriate, by writing in the spaces provided.

1. Are employers interested in hiring a generalist or specialist (please check (✓))? ____ generalist _____ specialist

(explain briefly) _____

_____

_____

_____

2. Do business, industry, and labor need to increasingly develop partnerships with secondary school trade and industrial education programs?

_____ yes

_____ no

If yes, what types of partnerships (e.g. attract additional funding and other sources of support) are needed? What barriers, if any exist, need to be overcome? What are some ways to create effective partnerships (describe briefly)?

_____

_____

_____

_____

3. In your opinion, how can ongoing adequate, quality, and effective trade and industrial education curriculum that is responsive to continuous change in the labor market be assured?

_____

_____

_____

_____

4. Are you or is your company involved in trade and industrial education advisory committees (e.g, input in curriculum updating, involved in equipment decisions)?

_____ yes
_____ no

If yes, has your or your company's involvement been productive (e.g., has your or your company's input been used)?

_____ yes
_____ no

(List the activities in which you have or your company has been involved):

_____

_____

_____

_____

. In the spaces below you may, if appropriate, further comment on issues covered in this survey; or comment on issues not covered in this survey that relate to the education and training needs of business, industry, and labor.

THANK YOU FOR COMPLETING THIS SURVEY

Appendix B

Local Curriculum Assessment Survey

Local Curriculum Assessment Survey

Secondary Trade and Industrial Education

The purpose of this survey is to determine the current status of secondary trade and industrial education curriculum in Indiana as perceived by local vocational education personnel. This survey contains 2 parts: Part I and Part II. Part I includes items and a rating scale. Part II includes open-ended questions. Complete the survey by following the directions for each part and providing your responses accordingly.

Your Position:
____ local vocational director
____ trade and industrial teacher
____ industrial cooperative education coordinator

Course(s) you teach or supervise:

___ Air Conditioning
___ Appliance Repair
___ Auto Body
___ Auto Mechanics
___ Aviation
___ Barbering
___ Business Machine Maintenance
___ Cabinet Making
___ Commercial Art
___ Commercial Fishery
___ Commercial Photography
___ Construction & Maintenance
___ Cosmetology
___ Custodial Service
___ Diesel Mechanics
___ Drafting
___ Dry Cleaning
___ Electrical
___ Electronics
___ Foremanship, Supervision, & Management Development
___ Furniture Making
___ Graphic Arts/Printing
___ Industrial Atomic Energy
___ Industrial Cooperative Training
___ Instrument Maintenance and Repair
___ Leather Working
___ Machine Shop
___ Maritime
___ Metal Fabrication
___ Metallurgy
___ Plastics
___ Precision food production
___ Public Service
___ Small Engine Repair
___ Stationary Energy Sources
___ Textile Production and Fabrication
___ Upholstering
___ Welding and Cutting
___ Other (please specify)
_____
_____
_____
_____

Part I

The purpose of Part I of this survey is to determine (a) how important various skills and knowledge are, (b) those skills and knowledge that are taught, and (c) the level of skills of students entering trade and industrial education programs.

Directions: Indicate, by circling the number, the degree of importance, whether instruction occurs, and level of student skills and knowledge for each of the skill/knowledge areas listed below.

Skill/Knowledge Area	Importance in T&I Program					Instruction in T&I Program			Entry Student Skill/Knowledge Level				
Mathematics	Not Important		Moderately Important		Very Important			Don't Know	Very Low	Low	Average	High	Very High
Basic													
Whole Numbers	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Fractions	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Decimals	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Percent	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Mixed Operations	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Measurement and Calculation	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Estimation	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Higher Order													
Algebra	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Geometry	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Trigonometry	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Calculus	1	2	3	4	5	Yes	No	DK	1	2	3	4	5

Skill/Knowledge Area	Importance in T&I Program					Instruction in T&I Program			Entry Student Skill/Knowledge Level				
Communications	Not Important		Moderately Important		Very Important			Don't Know	Very Low	Low	Average	High	Very High
Words and Meanings	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Reading	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Writing	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Speaking	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Listening	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Interpersonal Relations													
Work Behaviors	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Instructional and Supervisory Conversations	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Social Conversations	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Teamwork	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Change, Flexibility, and Adaptability Skills	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Reasoning													
Verbal Reasoning	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Problem Solving	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Planning	1	2	3	4	5	Yes	No	DK	1	2	3	4	5

Skill/Knowledge Area	Importance in T&I Program					Instruction in T&I Program			Entry Student Skill/Knowledge Level				
Science	Not Important		Moderately Important		Very Important			Don't Know	Very Low	Low	Average	High	Very High
General Science	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Earth and Atmospheric Science	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Biology	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Chemistry	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Physics	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Computer Technology													
Understand and use terminology	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Keyboarding	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Word processing	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Data processing	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Business applications	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Programming	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Networking	1	2	3	4	5	Yes	No	DK	1	2	3	4	5

Skill/Knowledge Area	Importance in T&I Program					Instruction in T&I Program			Entry Student Skill/Knowledge Level				
	Not Important		Moderately Important		Very Important			Don't Know	Very Low	Low	Average	High	Very High
General Occupational Skills													
Understand and follow safety rules and procedures for materials, tools, and equipment.	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Recognize signs and symbols in the workplace.	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Identify and determine the correct materials, tools,and equipment needed to accomplish a task.	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Operate technical equipment, tools, and instruments.	1	2	3	4	5	Yes	No	DK	1	2	3	4	5
Job - Specific Skills (i.e. those technical skills that are unique to a given job or occupation) (e.g., heating and air conditioning, auto mechanics, carpentry, electronics, machine shop, welding, graphic arts)	1	2	3	4	5	Yes	No	DK	1	2	3	4	5

What are some important new and emerging technical skill and knowledge areas (or programs and occupations) in the workplace (include any skill or knowledge area not listed above)?

_____

_____

_____

_____

Part II

The purpose of Part II of this survey is to obtain information regarding several curriculum issues and needs.

Directions: Respond to the following items by circling the appropriate number. In addition, you may further respond to any items, if appropriate, by writing in the spaces provided.

		Yes	No
1.	**Do effective partnerships exist between T&I programs and business, industry, and labor in your local program?**	1	2

If yes, describe them and how they have come about:

_____

_____

_____

_____

		Yes	No
2.	**In your local program, are there significant formal relationships existing between secondary T&I curriculum and other education content areas (e.g., mathematics, science)?**	1	2

If yes, describe them:

_____

_____

_____

_____

		Yes	No
3.	Are exploration programs (e.g., industrial technology/industrial arts) coordinated with secondary T&I programs in your local program?	1	2

If yes, describe the nature of this coordination:

_____

_____

_____

_____

4.	Are your secondary T&I programs articulated with postsecondary technical programs?	1	2

If yes, describe briefly the nature of the articulation:

_____

_____

_____

_____

5.	Are there any educational, economic, social, political, legislative, or other initiatives that have recently affected (or will affect) T&I curriculum in your local program?	1	2

If yes, describe:

_____

_____

_____

_____

		Yes	No
6.	Have increased graduation requirements affected your T&I programs?	1	2

If yes, describe the impact upon T&I programs:

_____

_____

_____

_____

		Yes	No
7.	Have basic skills had an impact on your T&I curriculum?	1	2

If yes, describe briefly:

_____

_____

_____

_____

		Yes	No
8.	In your local program, is secondary T&I curriculum regularly evaluated, updated, and revised?	1	2

If yes, describe the procedures used; if no, explain why:

_____

_____

_____

_____

		Yes	No
9.	In your local program, are students who complete T&I programs formally assessed to determine if they have attained the necessary entry level skills and knowledge for the world of work?	1	2

If yes, describe:

_____

_____

_____

_____

10.	Do your local programs use business, industry, and labor advisory committees?	1	2

If yes, are they active? How are they used? Are they effective?

_____

_____

_____

_____

11.	Are employers interested in hiring a specialist?	1	2

If no, a generalist? From your perspective, what levels of skills and knowledge do employers expect students to possess as they complete and leave secondary T&I programs and enter the job market in your local/regional area?

_____

_____

_____

_____

12. In the spaces below, you may address additional needs and/or comment on other issues related to the current status of secondary T&I curriculum in Indiana.

_____

_____

_____

_____

THANK YOU FOR COMPLETING THIS SURVEY

Appendix C

National Curriculum Assessment Survey

National Curriculum Assessment Survey

Secondary Trade and Industrial Education

_____
State

The purpose of this survey is to determine the current status of secondary trade and industrial (T&I) education curriculum in each of the 50 states, District of Columbia, and six surrounding territories as perceived by state T&I supervisors. Respond to the following items by circling the appropriate number. In addition, you may further respond to any items, if appropriate, by writing in the spaces provided.

		Yes	No
1.	Do effective partnerships exist between T&I programs and business, industry, and labor in your state?	1	2

If yes, describe them and how they have come about:

_____

_____

_____

_____

2.	In your state are there formal relationships existing between secondary T&I curriculum and other education content areas (e.g., mathematics, science)?	1	2

If yes, describe them:

_____

_____

_____

_____

		Yes	No
3.	Are exploration programs (e.g., industrial technology/industrial arts) coordinated with secondary T&I programs in your state?	1	2

If yes, describe the nature of this coordination:

_____

_____

_____

_____

		Yes	No
4.	In your state is secondary T&I curriculum articulated with postsecondary T&I curriculum?	1	2

If yes, describe briefly the nature of the articulation:

_____

_____

_____

_____

		Yes	No
5.	Are there any educational, economic, social, political, legislative, or other initiatives that have recently affected (or will affect) T&I curriculum in your state?	1	2

If yes, describe:

_____

_____

_____

_____

		Yes	No
6.	Has your state recently increased graduation requirements?	1	2

If yes, describe the impact upon T&I programs:

_____

_____

_____

_____

		Yes	No
7.	Have basic skills had an impact on T&I curriculum in your state?	1	2

If yes, please describe:

_____

_____

_____

_____

		Yes	No
8.	Is statewide competency/achievement testing having an impact on secondary T&I programs in your state?	1	2

If yes, please explain:

_____

_____

_____

_____

		Yes	No
9.	Do secondary T&I programs receive adequate funds and sufficient resources (e.g., materials, equipment) in your state?	1	2

If no, what is needed?

_____

_____

_____

_____

10.	In your state are there currently any initiatives or changes in the certification requirements or patterns for secondary T&I education instructors, or, are any anticipated?	1	2

Describe briefly the current certification requirements and patterns and any pending changes:

_____

_____

_____

_____

11.	In your state is secondary T&I curriculum regularly evaluated, updated, and revised?	1	2

If yes, describe the procedures used; if no, explain why:

_____

_____

_____

_____

		Yes	No
12.	In your state are there any secondary trade and industrial education curriculum evaluation and development/revision activities currently underway?	1	2

If yes, please describe and list any new or emerging programs:

_____

_____

_____

_____

13.	Do you perceive the knowledge and skills acquired in currently offered T&I programs to be consistent with the present or future employment and training needs of the world of work?	1	2

If no, why not:

_____

_____

_____

_____

14.	In your state are students who complete T&I programs formally assessed to determine if they have attained the necessary entry level skills and knowledge for the world of work?	1	2

If yes, describe:

_____

_____

_____

_____

		Yes	No
15.	In your state are advisory committees that include business, industry, and labor personnel actively involved in secondary T&I curriculum updating and revision activities?	1	2

If yes, describe the kinds of involvement:

_____

_____

_____

_____

16.	Are employers interested in hiring a specialist?	1	2

If no, a generalist? From your perspective, what level of skills and knowledge do employers expect students to possess as they complete and leave secondary T&I programs and enter the job market in your state?

_____

_____

_____

_____

17. In the spaces below, you may address additional needs and/or comment on other issues, or needed major curriculum changes related to the current status of secondary T&I curriculum in your state:

_____

_____

_____

_____

THANK YOU FOR COMPLETING THIS SURVEY

Appendix D

Business, Industry, and Labor and Local Survey Data Table

Importance of Skills and Knowledge in Companies and T&I programs, Entry Skills and Knowledge Levels of Employees and Students, and Occurrence of Skills and Knowledge Instruction in T&I Programs

SKILL KNOWLEDGE AREA		IMPORTANCE (in companies) BIL Survey LUR	M	P	Other	All	IMPORTANCE (in T&I programs) Local Survey D	I	C	All	ENTRY SKILL/KNOWLEDGE LEVEL (of employees) BIL Survey LUR	M	P	Other	All	(of T&I students) Local Survey D	I	C	All	INSTRUCTION (occuring in T&I programs) Local Survey D	I	C	All
Mathematics																							
Basic																							
Whole Numbers	n=	6	74	39	31	150	52	143	14	209	ndk=	0	2	1	4	7	3	3	3	9	n_y= 43	114	10	167
	x=	3.33	4.46	4.69	4.48	4.48	4.88	4.77	4.71	4.79	n=	6	71	35	26	138	45	138	11	194	n_n= 4	22	1	27
	SD=	.52	.91	.66	.85	.86	.32	.58	.61	.53	x=	3.17	3.55	3.31	3.54	3.47	3.04	3.09	3.09	3.08				
											SD=	.98	.91	.76	.76	.85	.67	.79	.94	.77				
Fractions	n=	6	72	40	30	148	52	144	14	210	ndk=	0	5	1	4	10	3	4	3	10	n_y= 43	117	10	170
	x=	3.67	4.15	4.18	4.30	4.17	4.81	4.61	4.50	4.65	n=	6	67	35	25	133	45	140	10	195	n_n= 4	18	1	23
	SD=	.82	1.13	1.03	.92	1.05	.44	.78	.76	.71	x=	3.17	3.27	2.94	3.40	3.20	2.67	2.56	2.40	2.57				
											SD=	.98	.90	.87	.71	.87	.80	.87	.70	.84				
Decimals	n=	5	72	37	31	145	52	143	14	209	ndk=	0	4	2	4	10	3	5	3	11	n_y= 41	114	10	165
	x=	4.20	4.29	4.38	4.19	4.29	4.79	4.55	4.50	4.60	n=	6	68	31	24	129	45	137	10	192	n_n= 6	21	1	28
	SD=	1.10	1.01	.95	1.05	1.00	.50	.81	.85	.75	x=	3.17	3.26	2.90	3.38	3.19	2.62	2.54	2.20	2.54				
											SD=	.98	.82	.98	.71	.86	.81	.81	.63	.80				
Percent	n=	6	71	38	32	147	52	143	14	209	ndk=	0	2	1	4	7	3	6	3	12	n_y= 40	108	9	157
	x=	3.50	4.15	4.26	3.97	4.12	4.60	4.10	4.36	4.24	n=	5	69	33	26	133	45	136	10	191	n_n= 7	26	2	35
	SD=	.84	.97	.83	1.12	.97	.69	1.04	.93	.98	x=	3.40	3.16	2.85	3.35	3.13	2.53	2.40	2.20	2.42				
											SD=	.89	.92	.97	.75	.91	.79	.78	.63	.78				
Mixed Operations	n=	5	72	32	30	139	50	142	14	206	ndk=	0	8	5	5	18	3	5	4	12	n_y= 40	103	10	153
	x=	3.40	3.88	3.63	4.00	3.83	4.66	4.24	4.00	4.33	n=	5	64	26	24	119	45	136	9	190	n_n= 7	30	1	88
	SD=	1.14	1.20	1.04	1.17	1.15	.63	.89	.88	.85	x=	3.40	3.05	2.69	3.33	3.04	2.53	2.39	2.11	2.41				
											SD=	1.14	1.03	.79	.76	.95	.89	.85	.60	.85				
Measurement and Calculation	n=	6	73	36	32	147	52	144	14	210	ndk=	0	6	2	4	12	5	6	3	14	n_y= 44	130	10	184
	x=	4.33	4.48	4.33	4.34	4.41	4.85	4.76	4.57	4.77	n=	6	67	29	25	127	43	136	10	189	n_n= 4	7	1	12
	SD=	1.03	.91	1.04	1.10	.98	.41	.61	.65	.57	x=	3.33	3.13	2.86	3.12	3.08	2.67	2.49	2.10	2.51				
											SD=	1.03	.97	.92	.83	.93	.87	.91	.57	.89				

SKILL KNOWLEDGE AREA		IMPORTANCE (in companies) BIL Survey LUR	M	P	Other	All	IMPORTANCE (in T&I programs) Local Survey D	I	C	All	ENTRY SKILL/KNOWLEDGE LEVEL (of employees) BIL Survey LUR	M	P	Other	All	ENTRY SKILL/KNOWLEDGE LEVEL (of T&I students) Local Survey D	I	C	All	INSTRUCTION (occuring in T&I programs) Local Survey D	I	C	All
Estimation	n=	5	70	37	31	143	51	142	14	207	ndk=	1	9	2	6	18	7	13	5	25	ny= 41	97	7	145
	x=	3.40	3.64	4.14	3.81	3.80	4.51	4.20	4.07	4.27	n=	4	62	30	22	118	40	126	7	173	nn= 7	33	4	44
	SD=	.55	1.13	.95	1.30	1.12	.70	.97	1.00	.92	x=	3.50	2.89	2.80	3.27	2.96	2.45	2.33	2.00	2.35				
											SD=	1.00	.89	.76	.88	.87	.96	.93	.58	.93				
ALL	n=	39	504	259	217	1019	361	1001	98	1460	ndk=	1	36	14	31	82	27	42	24	93	ny= 292	783	66	1141
	x=	3.69	4.15	4.24	4.16	4.16	4.73	4.46	4.39	4.52	n=	38	468	219	172	897	308	949	67	1324	nn= 39	157	11	207
	SD=	.89	1.07	.97	1.09	1.05	.56	.86	.83	.80	x=	3.29	3.19	2.92	3.34	3.16	2.65	2.55	2.33	2.56				
											SD=	.93	.93	.88	.77	.90	.84	.88	.75	.87				
Higher Order																								
Algebra	n=	6	70	36	29	141	51	142	14	207	ndk=	0	16	9	7	32	8	27	6	41	ny= 22	50	1	73
	x=	3.00	2.99	2.44	2.66	2.78	3.57	3.15	2.93	3.24	n=	6	56	23	20	105	40	109	7	156	nn= 21	81	11	113
	SD=	1.41	1.32	1.34	1.34	1.34	.83	1.40	1.14	1.28	x=	2.83	2.41	2.17	2.30	2.36	2.00	1.83	1.71	1.87				
											SD=	.75	1.06	1.15	1.08	1.07	.78	.82	.76	.81				
Geometry	n=	5	70	33	29	137	49	141	14	204	ndk=	0	16	11	8	35	9	21	6	36	ny= 25	55	1	81
	x=	2.80	3.00	2.42	2.76	2.80	3.65	3.29	2.93	3.35	n=	5	55	19	19	98	38	113	7	158	nn= 19	73	11	103
	SD=	.84	1.36	1.25	1.38	1.33	.97	1.38	1.00	1.28	x=	3.00	2.27	1.84	2.26	2.22	1.92	1.71	1.71	1.76				
											SD=	.71	.95	1.01	.93	.97	.88	.78	.76	.80				
Trigonometry	n=	5	70	33	29	137	50	137	13	200	ndk=	1	20	12	8	41	13	35	6	54	ny= 18	29	1	48
	x=	2.80	2.54	2.09	2.31	2.39	3.02	2.62	2.15	2.69	n=	4	51	18	19	92	35	94	7	136	nn= 25	97	11	133
	SD=	.84	1.40	1.38	1.39	1.38	1.10	1.45	1.14	1.36	x=	3.25	2.14	1.44	2.16	2.05	1.69	1.46	1.71	1.53				
											SD=	.50	1.00	.92	1.01	1.03	.83	.65	.76	.71				
Calculus	n=	5	69	32	28	134	49	132	14	195	ndk=	0	22	15	8	45	16	44	7	67	ny= 6	3	0	9
	x=	2.80	1.99	1.59	1.93	1.91	2.29	1.81	1.93	1.94	n=	5	48	15	18	86	29	82	6	117	nn= 34	122	12	168
	SD=	.84	1.05	.87	1.21	1.06	1.10	1.03	1.14	1.07	x=	2.80	1.88	1.20	2.00	1.84	1.52	1.29	1.50	1.36				
											SD=	.45	1.00	.56	.84	.92	.83	.56	.84	.65				
ALL	n=	21	279	134	115	549	199	552	55	806	ndk=	1	74	47	31	153	46	127	25	198	ny= 71	137	3	211
	x=	2.86	2.63	2.15	2.42	2.48	3.14	2.73	2.49	2.82	n=	20	210	75	76	381	142	398	27	567	nn= 99	373	45	517
	SD=	.96	1.35	1.27	1.36	1.33	1.14	1.44	1.17	1.37	x=	2.95	2.19	1.72	2.18	2.13	1.80	1.60	1.67	1.65				
											SD=	.60	1.01	1.02	.96	1.02	.84	.75	.73	.78				

SKILL KNOWLEDGE AREA		IMPORTANCE (in companies) BIL Survey LUR	M	P	Other	ALL	IMPORTANCE (in T&I programs) Local Survey D	I	C	ALL		ENTRY SKILL/KNOWLEDGE LEVEL (of employees) BIL Survey LUR	M	P	Other	ALL	(of T&I students) Local Survey D	I	C	ALL	INSTRUCTION (occuring in T&I programs) Local Survey D	I	C	ALL
ALL	n=	60	783	393	332	1568	560	1553	153	2266	ndk=	2	110	61	62	235	73	169	49	291	n_y= 363	920	69	1352
	x=	3.40	3.61	3.53	3.55	3.57	4.16	3.85	3.71	3.92	n=	58	678	294	248	1278	450	1347	94	1891	n_n= 138	530	56	724
	SD=	.99	1.39	1.47	1.45	1.41	1.11	1.38	1.33	1.32	x=	3.17	2.88	2.62	2.99	2.85	2.38	2.27	2.14	2.29				
											SD=	.84	1.06	1.05	.99	1.05	.93	.95	.80	.94				
Communications																								
Words and Meanings	n=	6	75	38	34	153	51	145	12	208	ndk=	0	3	2	5	10	3	10	3	16	n_y= 34	106	9	149
	x=	3.67	4.21	4.16	4.38	4.22	4.27	4.19	4.42	4.23	n=	5	71	34	27	137	46	133	9	188	n_n= 13	33	2	48
	SD=	.82	.84	.79	.82	.83	.67	.78	.67	.75	x=	3.00	3.15	3.09	3.33	3.17	2.76	2.67	2.44	2.68				
											SD=	0	.71	.57	.73	.67	.77	.73	.73	.73				
Reading	n=	6	75	38	35	154	51	146	12	209	ndk=	0	3	2	5	10	3	8	2	13	n_y= 30	87	10	127
	x=	4.33	4.32	4.34	4.46	4.36	4.63	4.36	4.75	4.45	n=	6	71	35	27	139	46	135	10	191	n_n= 16	51	1	68
	SD=	.82	.84	.85	.66	.80	.56	.71	.45	.68	x=	3.33	3.21	3.06	3.44	3.22	2.70	2.59	2.70	2.62				
											SD=	.82	.86	.48	.80	.77	.81	.69	.48	.71				
Writing	n=	6	75	37	33	151	50	146	12	208	ndk=	0	3	2	5	10	3	9	3	15	n_y= 27	78	8	113
	x=	4.00	3.92	3.86	4.06	3.94	4.10	3.92	4.00	3.97	n=	6	71	34	26	137	46	135	9	190	n_n= 18	60	3	81
	SD=	.89	.97	.98	.93	.95	.71	.89	1.04	.86	x=	2.83	3.07	2.76	3.31	3.03	2.50	2.41	2.33	2.43				
											SD=	.41	.76	.65	.79	.75	.84	.76	.71	.77				
Speaking	n=	6	75	38	33	152	51	145	12	208	ndk=	0	3	2	6	11	4	8	3	15	n_y= 28	71	9	108
	x=	4.17	3.96	4.21	4.15	4.07	4.10	3.81	4.33	3.91	n=	6	71	33	25	135	45	133	9	187	n_n= 17	66	2	85
	SD=	.98	.92	.91	.87	.91	.81	.91	.89	.89	x=	3.33	3.17	3.12	3.28	3.19	2.62	2.61	2.67	2.61				
											SD=	.52	.79	.60	.79	.73	.87	.69	.50	.73				
Listening	n=	6	75	39	34	154	51	146	12	209	ndk=	0	3	2	5	10	2	8	3	13	n_y= 34	106	8	148
	x=	4.67	4.68	4.72	4.62	4.68	4.67	4.53	4.75	4.58	n=	6	71	35	27	139	47	135	9	191	n_n= 11	32	3	46
	SD=	.52	.66	.56	.60	.61	.51	.71	.62	.66	x=	3.67	3.24	3.20	3.37	3.27	2.70	2.53	2.56	2.57				
											SD=	1.51	.78	.63	.74	.78	.88	.84	.53	.84				
ALL	n=	30	375	190	169	764	254	728	60	1042	ndk=	0	15	10	26	51	15	43	14	72	n_y= 153	448	44	645
	x=	4.17	4.22	4.26	4.34	4.25	4.36	4.16	4.45	4.23	n=	29	355	171	132	687	230	671	46	947	n_n= 75	242	11	328
	SD=	.83	.89	.86	.80	.86	.70	.85	.79	.82	x=	3.24	3.17	3.05	3.35	3.18	2.66	2.56	2.54	2.58				
											SD=	.83	.78	.60	.76	.74	.84	.75	.59	.76				

SKILL KNOWLEDGE AREA		IMPORTANCE (in companies) BIL Survey LUR	M	P	Other	All	IMPORTANCE (in T&I programs) Local Survey D	I	C	All	ENTRY SKILL/KNOWLEDGE LEVEL (of employees) BIL Survey LUR	M	P	Other	All	ENTRY SKILL/KNOWLEDGE LEVEL (of T&I students) Local Survey D	I	C	All	INSTRUCTION (occuring in T&I programs) Local Survey D	I	C	All
Interpersonal Relations																								
Work Behaviors	n=	6	75	40	35	156	50	143	12	205	ndk=	0	3	2	5	10	3	6	2	11	n_y=	44	154	10	188
	x=	4.00	4.33	4.63	4.63	4.56	4.78	4.78	4.75	4.78	n=	6	72	34	26	138	47	136	9	192	n_n=	2	5	1	6
	SD=	.89	.62	.54	.55	.60	.51	.52	.45	.51	x=	3.17	3.21	3.38	3.38	3.28	2.87	2.70	2.78	2.74					
											SD=	.98	.82	.65	.94	.81	.90	.92	.97	.92					
Instructional and Supervisory Conversation	n=	6	73	37	32	148	50	141	12	203	ndk=	1	3	2	5	11	4	9	2	15	n_y=	38	113	10	161
	x=	4.00	4.14	4.08	4.44	4.18	4.40	4.28	4.25	4.31	n=	5	71	33	25	134	46	132	10	188	n_n=	7	25	1	33
	SD=	.63	.89	.92	.72	.86	.81	.76	.75	.77	x=	3.20	3.18	2.94	3.28	3.14	2.50	2.58	2.40	2.55					
											SD=	1.10	.80	.61	.79	.77	.98	.82	.70	.85					
Social Conversations	n=	6	74	37	31	148	50	143	13	206	ndk=	0	8	6	5	19	4	11	2	17	n_y=	24	68	8	100
	x=	3.00	3.12	3.51	3.58	3.31	3.64	3.52	3.85	3.57	n=	6	67	29	25	127	44	131	11	186	n_n=	21	68	3	92
	SD=	.89	.98	1.04	1.26	1.07	.96	.93	.90	.93	x=	3.00	3.10	3.10	3.36	3.15	2.91	2.84	3.18	2.88					
											SD=	.63	.76	.72	.95	.79	.91	.75	.60	.79					
Teamwork	n=	6	75	40	35	156	50	146	13	209	ndk=	0	3	3	5	11	3	6	2	11	n_y=	43	131	10	184
	x=	4.67	4.67	4.65	4.66	4.66	4.58	4.58	4.77	4.59	n=	6	71	33	26	136	47	138	11	196	n_n=	3	7	1	11
	SD=	.52	.58	.66	.68	.62	.64	.67	.44	.65	x=	3.83	3.31	3.58	3.38	3.41	2.77	2.78	2.82	2.78					
											SD=	.98	.87	.90	.90	.89	.98	.90	1.08	.92					
Change, Flexibility and Adaptability Skills	n=	6	75	37	34	152	50	143	13	206	ndk=	0	3	3	5	11	3	5	2	10	n_y=	37	125	10	172
	x=	4.33	4.59	4.43	4.56	4.53	4.56	4.53	4.69	4.54	n=	6	72	33	27	138	47	138	11	196	n_n=	8	12	1	21
	SD=	.82	.64	.77	.79	.71	.65	.66	.63	.65	x=	3.33	3.11	3.24	3.30	3.19	2.64	2.59	2.45	2.60					
											SD=	1.37	.86	.79	.82	.86	.94	.86	.93	.88					
ALL	n=	30	372	191	167	760	250	716	63	1029	ndk=	1	20	16	25	62	17	37	10	64	n_y=	186	571	48	805
	x=	4.00	4.21	4.27	4.39	4.26	4.39	4.34	4.46	4.36	n=	29	353	162	129	673	231	675	52	958	n_n=	41	115	7	163
	SD=	.91	.95	.90	.90	.93	.82	.84	.74	.83	x=	3.31	3.18	3.25	3.34	3.24	2.74	2.70	2.73	2.71					
											SD=	1.00	.82	.77	.87	.83	.95	.86	.89	.88					
Reasoning																								
Verbal Reasoning	n=	6	75	39	34	154	49	143	13	205	ndk=	0	5	3	5	13	6	12	4	22	n_y=	27	93	7	127
	x=	4.00	4.08	4.51	4.44	4.27	4.20	4.14	4.15	4.16	n=	6	70	33	26	135	44	132	9	185	n_n=	16	40	4	60
	SD=	.89	.83	.68	.89	.83	.74	.84	.69	.80	x=	3.33	3.04	3.18	3.23	3.13	2.57	2.45	2.33	2.47					
											SD=	1.21	.82	.64	.86	.81	.79	.71	.50	.72					

SKILL KNOWLEDGE AREA		IMPORTANCE (in companies) BIL Survey LUR	M	P	Other	ALL	IMPORTANCE (in companies) Local Survey D	I	C	ALL		ENTRY SKILL/KNOWLEDGE LEVEL (of employees) BIL Survey LUR	M	P	Other	ALL	ENTRY SKILL/KNOWLEDGE LEVEL (of employees) Local Survey D	I	C	ALL	INSTRUCTION (occuring in T&I programs) Local Survey D	I	C	ALL
Problem Solving	n=	6	74	38	34	152	49	145	13	207	ndk=	0	4	3	5	12	6	8	3	17	n_y= 42	136	9	187
	x=	4.33	4.49	4.63	4.56	4.53	4.57	4.72	4.62	4.68	n=	6	71	33	26	136	44	135	10	189	n_n= 2	2	2	6
	SD=	.82	.80	.54	.79	.74	.54	.55	.77	.56	x=	3.50	3.17	3.21	2.96	3.15	2.64	2.41	2.30	2.46				
											SD=	1.72	.93	.70	.72	.85	.94	.79	.48	.82				
Planning	n=	6	75	39	34	154	49	145	13	207	ndk=	0	7	4	5	16	6	10	3	19	n_y= 40	125	9	174
	x=	4.17	4.13	4.21	4.32	4.19	4.45	4.59	4.38	4.55	n=	6	68	33	26	133	44	133	10	187	n_n= 4	9	2	15
	SD=	.75	.93	1.00	.91	.94	.58	.64	.77	.64	x=	3.17	2.84	2.79	3.00	2.87	2.59	2.36	2.10	2.40				
											SD=	1.17	.94	.86	.89	.92	1.00	.86	.57	.89				
ALL	n=	18	224	116	102	460	147	433	39	619	ndk=	0	16	10	15	41	18	30	10	58	n_y= 109	354	25	488
	x=	4.17	4.23	4.45	4.44	4.33	4.41	4.48	4.38	4.46	n=	18	209	99	78	404	132	400	29	561	n_n= 22	51	8	81
	SD=	.79	.87	.78	.86	.85	.64	.73	.75	.71	x=	3.33	3.02	3.06	3.06	3.05	2.60	2.41	2.24	2.44				
											SD=	1.14	.90	.75	.83	.87	.91	.79	.51	.81				
Science																								
General Science	n=	6	74	38	31	149	50	142	14	206	ndk=	0	20	10	9	39	7	40	8	55	n_y= 16	45	2	63
	x=	1.83	2.51	2.13	2.55	2.40	3.48	3.12	3.71	3.25	n=	5	52	24	18	99	38	101	5	144	n_n= 29	92	9	130
	SD=	1.33	1.25	1.17	1.15	1.22	.91	1.26	1.07	1.19	x=	2.40	2.56	2.54	2.67	2.57	2.53	2.48	2.60	2.49				
											SD=	1.14	.87	.59	.69	.78	.76	.72	.55	.72				
Earth and Atomospheric Science	n=	5	74	37	30	146	49	141	14	204	ndk=	1	24	12	11	48	11	48	8	67	n_y= 8	25	1	34
	x=	1.40	1.97	1.86	2.13	1.96	2.88	2.50	3.29	2.64	n=	4	49	23	16	92	33	93	5	131	n_n= 37	112	10	159
	SD=	.89	1.05	1.13	1.04	1.04	.90	1.20	.99	1.15	x=	2.50	2.29	2.35	2.31	2.32	2.33	2.12	2.20	2.18				
											SD=	1.29	.84	.57	.70	.77	.89	.75	.84	.79				
Biology	n=	5	74	38	30	147	50	140	14	204	ndk=	1	23	13	11	48	11	54	9	74	n_y= 7	13	0	20
	x=	1.00	1.78	1.53	1.83	1.70	2.72	2.00	2.57	2.22	n=	4	49	21	16	90	33	87	3	123	n_n= 37	121	10	168
	SD=	0.00	.97	.80	.91	.91	.83	.96	.76	.97	x=	2.25	2.08	1.95	2.25	2.09	2.36	2.13	2.33	2.20				
											SD=	1.50	.84	.74	.77	.83	.78	.77	.58	.78				
Chemistry	n=	5	74	38	30	147	49	141	14	204	ndk=	0	21	13	10	44	10	47	8	65	n_y= 13	31	1	45
	x=	1.80	2.34	1.97	2.57	2.27	3.00	2.74	2.93	2.81	n=	5	51	21	17	94	34	92	4	130	n_n= 30	133	10	143
	SD=	1.10	1.22	1.22	1.25	1.23	.89	1.16	.73	1.08	x=	1.80	2.29	2.00	2.41	2.22	2.03	1.80	2.00	1.87				
											SD=	1.10	.86	.77	1.06	.89	.83	.74	.82	.77				

SKILL KNOWLEDGE AREA		IMPORTANCE (in companies) BIL Survey LUR	M	P	Other	All	IMPORTANCE (in T&I programs) Local Survey D	I	C	All		ENTRY SKILL/KNOWLEDGE LEVEL (of employees) BIL Survey LUR	M	P	Other	All	(of T&I students) Local Survey D	I	C	All	INSTRUCTION (occuring in T&I programs) Local Survey	D	I	C	All
Physics	n=	5	74	38	30	147	49	139	14	202	ndk=	0	20	13	10	43	11	43	8	62	n_y=	21	47	0	68
	x=	2.00	2.42	2.29	2.57	2.40	3.33	3.09	3.21	3.16	n=	5	53	21	17	96	33	97	4	134	n_n=	23	89	11	123
	SD=	1.41	1.24	1.41	1.28	1.29	1.05	1.25	.97	1.19	x=	2.00	2.13	2.05	2.41	2.16	1.91	1.90	1.75	1.90					
											SD=	1.41	.81	.67	1.00	.85	.86	.80	.96	.81					
ALL	n=	26	370	189	151	736	247	703	70	1020	ndk=	2	108	61	51	222	50	232	41	323	n_y=	65	161	4	230
	x=	1.62	2.21	1.96	2.33	2.15	3.08	2.69	3.14	2.82	n=	23	254	110	84	471	171	470	21	662	n_n=	156	517	50	723
	SD=	1.06	1.18	1.16	1.16	1.18	.96	1.24	.97	1.18	x=	2.17	2.27	2.19	2.42	2.27	2.24	2.09	2.19	2.13					
											SD=	1.19	.85	.70	.85	.84	.84	.79	.75	.80					
Computer Technology																									
Understand and use terminology	n=	5	71	37	32	145	51	138	14	203	ndk=	0	12	7	9	28	7	46	7	60	n_y=	27	66	7	100
	x=	2.80	3.34	3.03	3.59	3.30	3.90	3.28	3.93	3.48	n=	5	59	26	22	112	41	97	7	145	n_n=	17	68	5	90
	SD=	1.79	1.30	1.38	1.19	1.32	.94	1.37	1.00	1.28	x=	2.20	2.66	2.69	2.73	2.66	2.56	2.35	2.57	2.42					
											SD=	1.30	.99	.97	.94	.98	.95	.96	.53	.94					
Keyboarding	n=	5	72	37	32	146	51	139	14	204	ndk=	0	13	9	8	30	6	53	7	66	n_y=	18	43	4	65
	x=	2.40	3.49	2.76	3.56	3.28	3.45	2.96	3.64	3.13	n=	5	59	24	22	110	42	91	7	140	n_n=	26	89	8	123
	SD=	1.34	1.32	1.50	1.27	1.39	.90	1.37	1.34	1.29	x=	2.60	2.80	2.54	2.77	2.73	2.24	2.21	2.57	2.24					
											SD=	1.14	1.10	1.02	1.07	1.07	1.01	.31	.98	.94					
Word Processing	n=	5	71	36	32	144	50	137	14	201	ndk=	0	13	12	9	34	11	63	6	80	n_y=	16	16	3	35
	x=	2.20	3.00	2.31	3.22	2.85	3.04	2.31	3.00	2.54	n=	5	58	20	21	104	37	80	7	124	n_n=	27	115	9	151
	SD=	1.10	1.28	1.11	1.41	1.37	1.12	1.20	1.30	1.23	x=	2.60	2.53	2.35	2.71	2.54	2.22	1.86	2.14	1.98					
											SD=	1.14	1.03	1.09	1.15	1.06	1.06	.85	.90	.93					
Data Processing	n=	5	71	37	30	143	50	137	13	200	ndk=	0	13	13	10	36	11	72	7	90	n_y=	14	10	3	27
	x=	2.40	3.04	2.03	2.93	2.73	2.96	2.23	3.00	2.46	n=	5	58	20	18	101	35	71	7	113	n_n=	29	118	9	156
	SD=	1.34	1.30	1.19	1.41	1.36	1.12	1.16	1.08	1.19	x=	2.40	2.59	2.20	2.44	2.48	2.00	1.76	2.00	1.85					
											SD=	.89	1.03	.83	.92	.97	1.03	.73	.82	.84					
Business Applications	n=	5	71	38	31	145	50	139	14	203	ndk=	0	17	12	11	40	8	69	7	84	n_y=	22	25	4	51
	x=	2.00	2.96	2.55	3.06	2.84	3.32	2.63	3.29	2.84	n=	5	54	22	18	99	39	74	7	120	n_n=	21	106	8	135
	SD=	1.41	1.28	1.39	1.34	1.34	1.06	1.23	1.27	1.25	x=	2.00	2.50	2.55	2.44	2.47	2.23	1.85	2.00	1.98					
											SD=	.71	.93	1.18	.92	.97	1.01	.73	.58	.84					

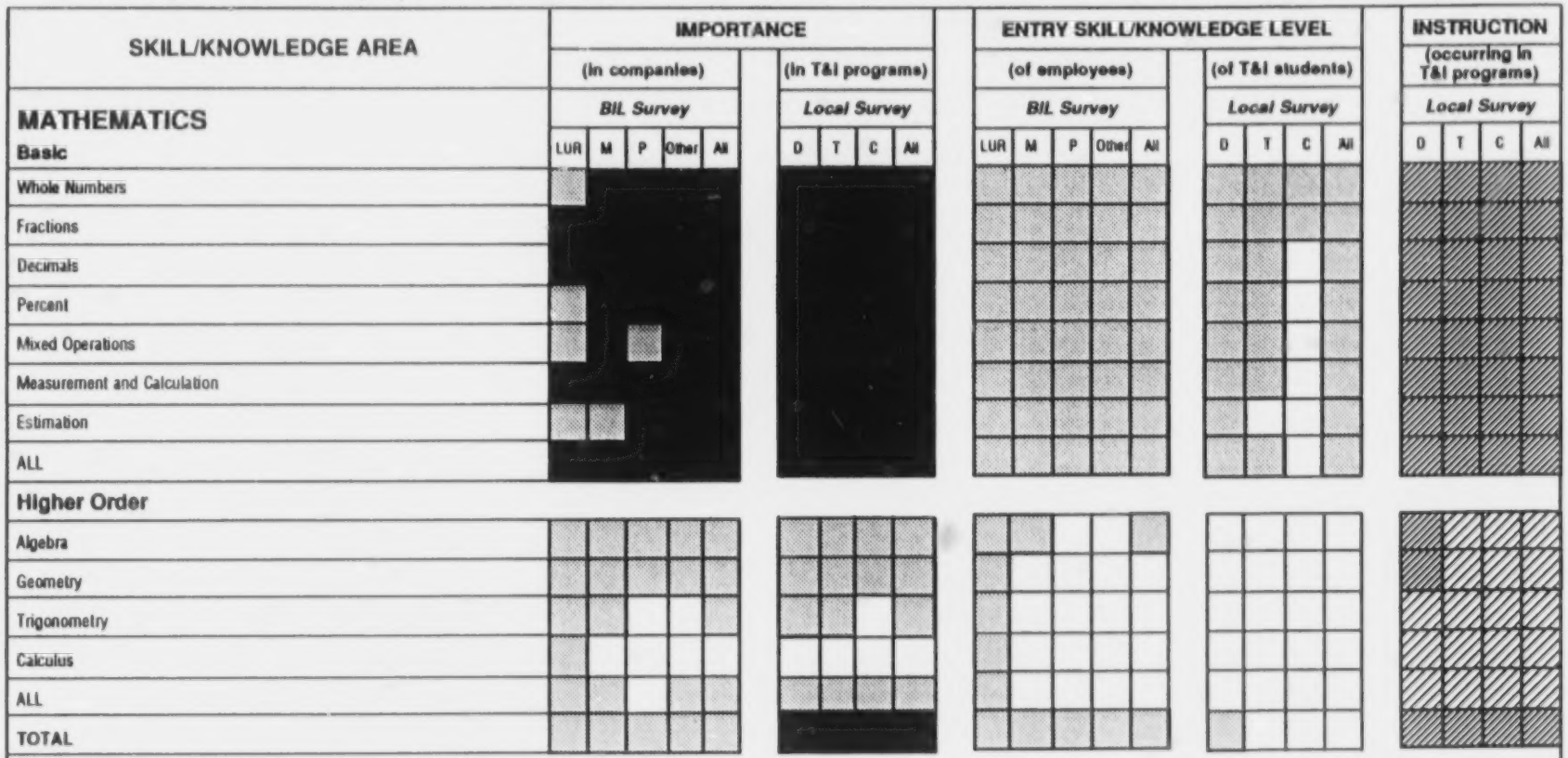
		IMPORTANCE (in companies)					IMPORTANCE (in T&I programs)					ENTRY SKILL/KNOWLEDGE LEVEL (of employees)					ENTRY SKILL/KNOWLEDGE LEVEL (of T&I students)					INSTRUCTION (occuring in T&I programs)				
		BIL Survey					Local Survey					BIL Survey					Local Survey					Local Survey			
SKILL KNOWLEDGE AREA		LUR	M	P	Other	All	D	I	C	All		LUR	M	P	Other	All	D	I	C	All		D	I	C	All
Programming	n=	5	71	36	30	142	50	139	14	203	ndk=	0	17	12	11	40	12	67	7	86	n_y=	15	22	2	39
	x=	2.20	2.65	2.06	2.43	2.44	2.46	2.20	2.29	2.27	n=	5	52	20	17	94	35	77	7	119	n_n=	29	109	10	148
	SD=	1.30	1.29	1.26	1.33	1.30	1.20	1.24	1.27	1.23	x=	2.40	2.38	1.80	2.24	2.23	1.80	1.77	1.43	1.76					
											SD=	.89	1.09	.83	.97	1.02	.96	.77	.79	.83					
Networking	n=	5	71	35	29	140	50	136	14	200	ndk=	0	16	15	12	43	13	73	7	93	n_y=	12	12	2	26
	x=	2.40	2.72	1.83	2.31	2.40	2.52	2.10	2.43	2.23	n=	5	53	17	16	91	32	70	7	109	n_n=	30	119	10	158
	SD=	1.34	1.36	1.22	1.17	1.33	1.22	1.16	1.34	1.20	x=	2.60	2.19	1.71	2.25	2.13	1.91	1.71	1.43	1.75					
											SD=	1.14	1.09	.69	.86	1.00	1.06	.76	.79	.86					
ALL	n=	35	498	256	216	1005	352	965	97	1414	ndk=	0	101	80	70	251	68	443	48	559	n_y=	124	194	25	343
	x=	2.34	3.03	2.37	3.03	2.84	3.10	2.53	3.08	2.71	n=	35	393	149	134	711	261	560	49	870	n_n=	179	723	59	961
	SD=	1.28	1.33	1.39	1.37	1.38	1.18	1.32	1.32	1.31	x=	2.40	2.53	2.30	2.54	2.48	2.15	1.96	2.02	2.02					
											SD=	.98	1.04	1.01	.99	1.03	1.03	.86	.85	.92					
General Occupational Skills																									
Understand and follow safety rules and procedures for materials, tools, and equipment.	n=	6	75	40	35	156	51	146	13	210	ndk=	0	3	1	3	7	2	7	2	11	n_y=	44	138	12	194
	x=	4.67	4.69	4.78	4.60	4.62	4.94	4.93	4.92	4.93	n=	5	72	36	27	140	49	135	11	195	n_n=	0	0	0	0
	SD=	.52	.70	.53	1.01	.73	.24	.30	.28	.29	x=	3.20	3.42	3.42	3.48	3.42	3.12	2.95	2.73	2.98					
											SD=	1.30	.92	.77	.70	.85	1.05	.88	.47	.91					
Recognize signs and symbols in the workplace	n=	6	75	39	34	154	51	146	13	210	ndk=	0	3	2	4	9	2	11	2	15	n_y=	43	131	10	184
	x=	4.50	4.37	4.54	4.12	4.36	4.84	4.77	4.69	4.78	n=	5	72	34	25	136	49	131	11	191	n_n=	1	7	2	10
	SD=	.55	.90	.68	1.37	.97	.42	.64	.48	.59	x=	3.40	3.44	3.50	3.32	3.43	2.98	2.70	2.64	2.77					
											SD=	1.14	1.01	.83	.75	.92	1.03	.97	.81	.98					
Identify and determine the correct materials, tools, and equipment needed to accomplish a task.	n=	6	75	40	34	155	51	146	13	210	ndk=	0	4	1	3	8	2	8	2	12	n_y=	44	135	10	189
	x=	4.33	4.53	4.80	4.56	4.60	4.88	4.90	4.85	4.90	n=	5	71	36	27	139	49	134	12	195	n_n=	0	3	2	5
	SD=	.82	.79	.46	.89	.75	.33	.38	.38	.36	x=	3.60	3.27	3.50	3.59	3.40	2.94	2.60	2.58	2.69					
											SD=	1.14	.98	.88	.93	.95	1.05	1.02	.67	1.02					

		IMPORTANCE (in companies) BIL Survey					IMPORTANCE (in T&I programs) Local Survey				ENTRY SKILL/KNOWLEDGE LEVEL (of employees) BIL Survey					ENTRY SKILL/KNOWLEDGE LEVEL (of T&I students) Local Survey				INSTRUCTION (occuring in T&I programs) Local Survey			
SKILL KNOWLEDGE AREA		LUR	M	P	Other	All	D	I	C	All		LUR	M	P	Other	All	D	I	C	All		D	I	C	All
Operate technical equipment, tools, and instruments.	n=	6	74	39	34	153	51	146	13	210	ndk=	0	4	2	3	9	2	9	2	13	n_y=	44	134	11	189
	x=	4.33	4.46	4.59	4.41	4.48	4.82	4.83	4.54	4.81	n=	5	70	34	26	135	49	132	12	193	n_n=	0	3	1	4
	SD=	.82	.96	.94	1.05	.95	.43	.52	.78	.52	x=	3.40	3.27	3.35	3.35	3.31	2.80	2.45	2.75	2.55					
											SD=	1.14	1.01	.92	.85	.95	1.08	1.01	.62	1.01					
ALL	n=	24	299	158	137	618	204	584	52	840	ndk=	0	14	6	13	33	8	35	8	51	n_y=	175	538	43	756
	x=	4.46	4.52	4.68	4.42	4.53	4.87	4.86	4.75	4.85	n=	20	285	140	105	550	196	532	46	774	n_n=	1	13	5	19
	SD=	.66	.84	.68	1.10	.87	.36	.48	.52	.46	x=	3.40	3.35	3.44	3.44	3.39	2.96	2.68	2.67	2.75					
											SD=	1.10	.98	.84	.81	.92	1.05	.98	.63	.99					
Job-Specific Skills (i.e. those technical skills that are unique to a given job or occupation)(e.g., heating and air conditioning, auto mechanics, carpentry, electronics, machine shop, welding, graphic arts)	n=	5	70	36	31	142	51	145	14	210	ndk=	0	3	2	3	8	4	9	2	15	n_y=	41	132	11	184
	x=	4.40	4.47	4.36	4.55	4.46	4.80	4.78	4.43	4.76	n=	5	65	33	24	127	47	130	11	188	n_n=	2	3	1	6
	SD=	.55	.88	1.10	.85	.92	.45	.58	.76	.57	x=	3.00	3.31	3.30	3.29	3.29	2.81	2.40	2.45	2.51					
											SD=	.71	1.03	.92	.91	.96	1.10	1.02	.69	1.04					

Appendix E

Skill and Knowledge Chart

Importance of skills and knowledge in companies and trade and industrial (T&I) education programs, entry skill and knowledge levels of employees and students, and occurrence of skills and knowledge instruction in T&I programs



KEY

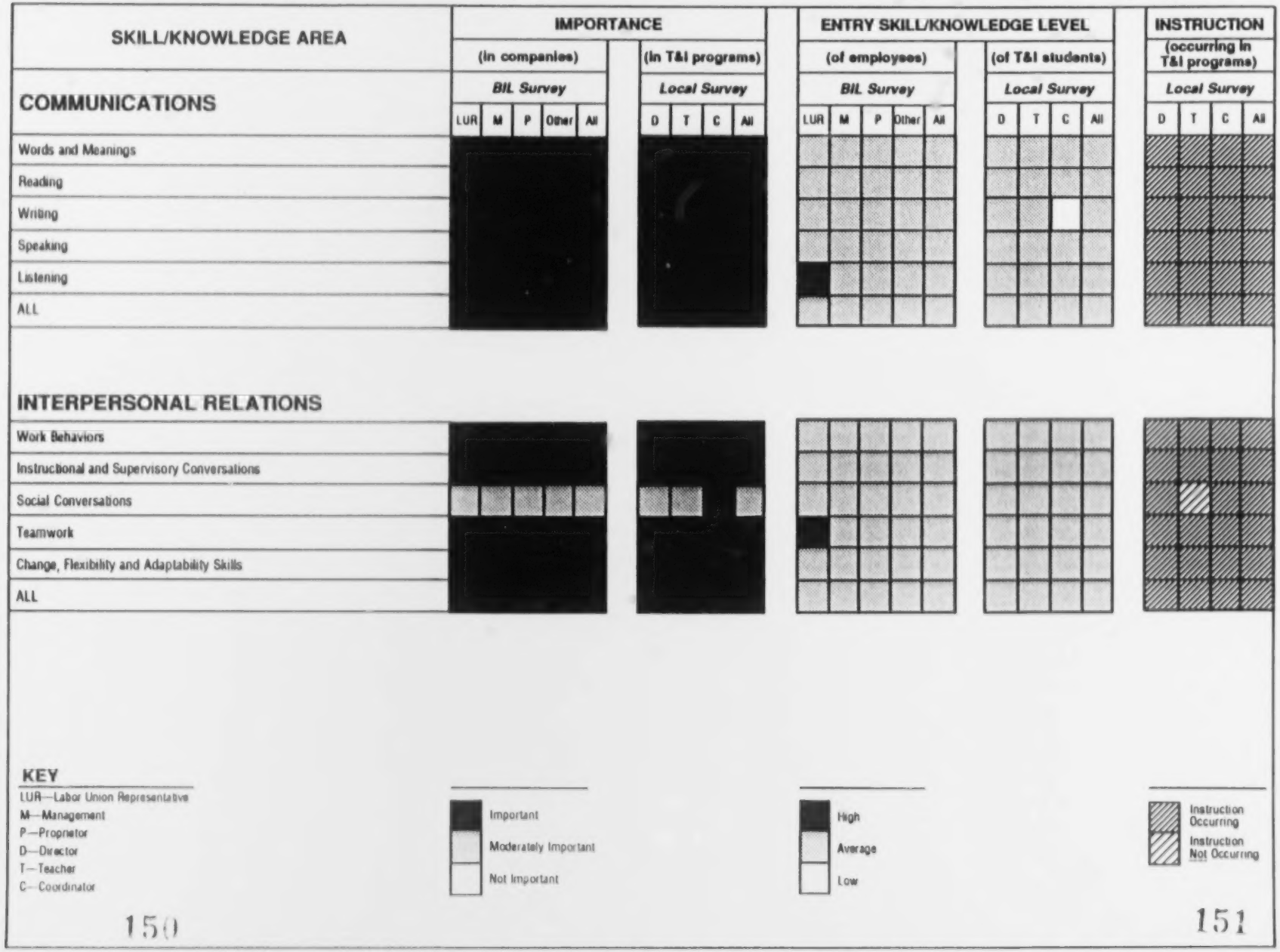
LUR—Labor Union Representative
M—Management
P—Proprietor
D—Director
T—Teacher
C—Coordinator

Important
Moderately Important
Not Important

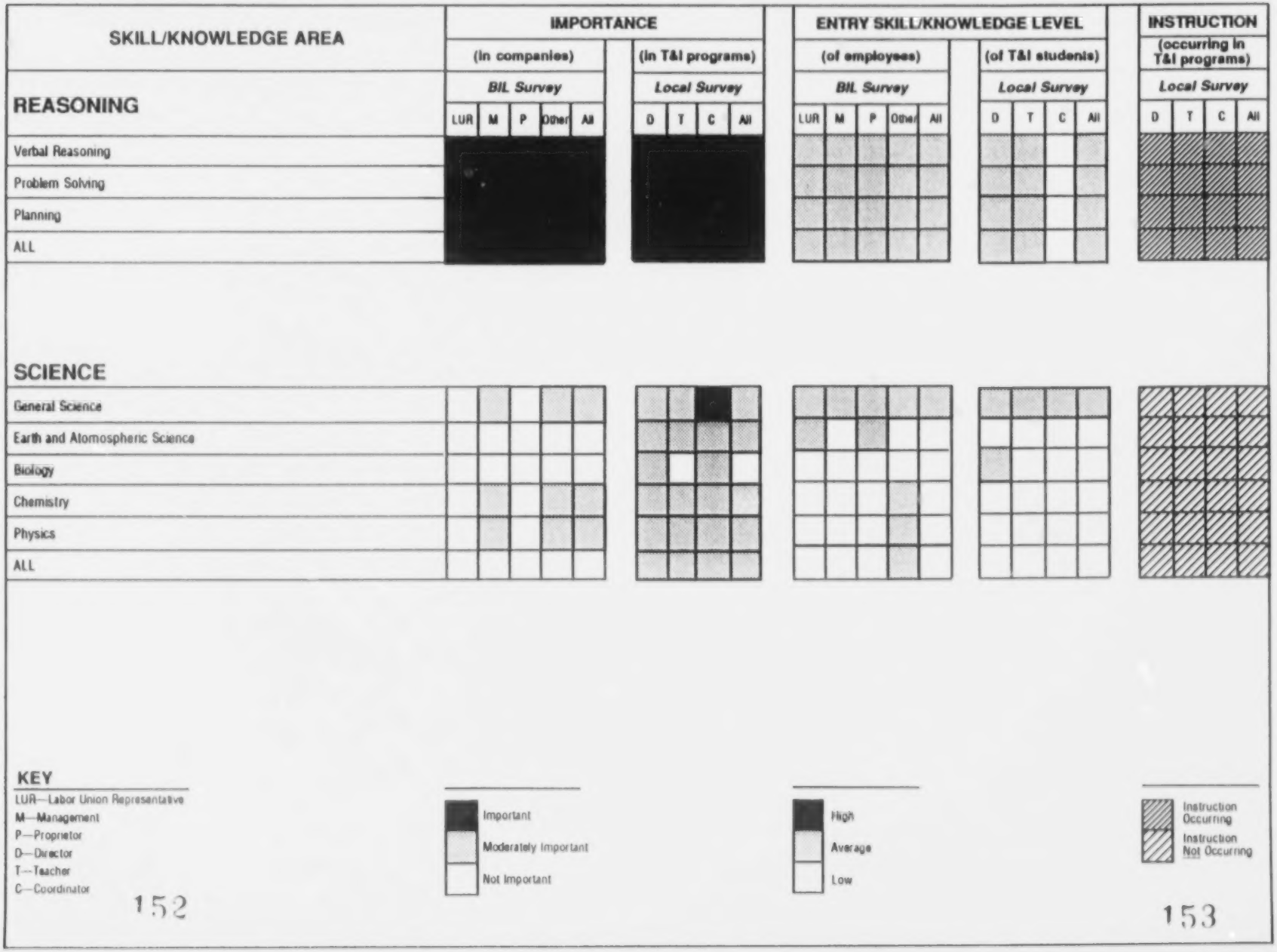
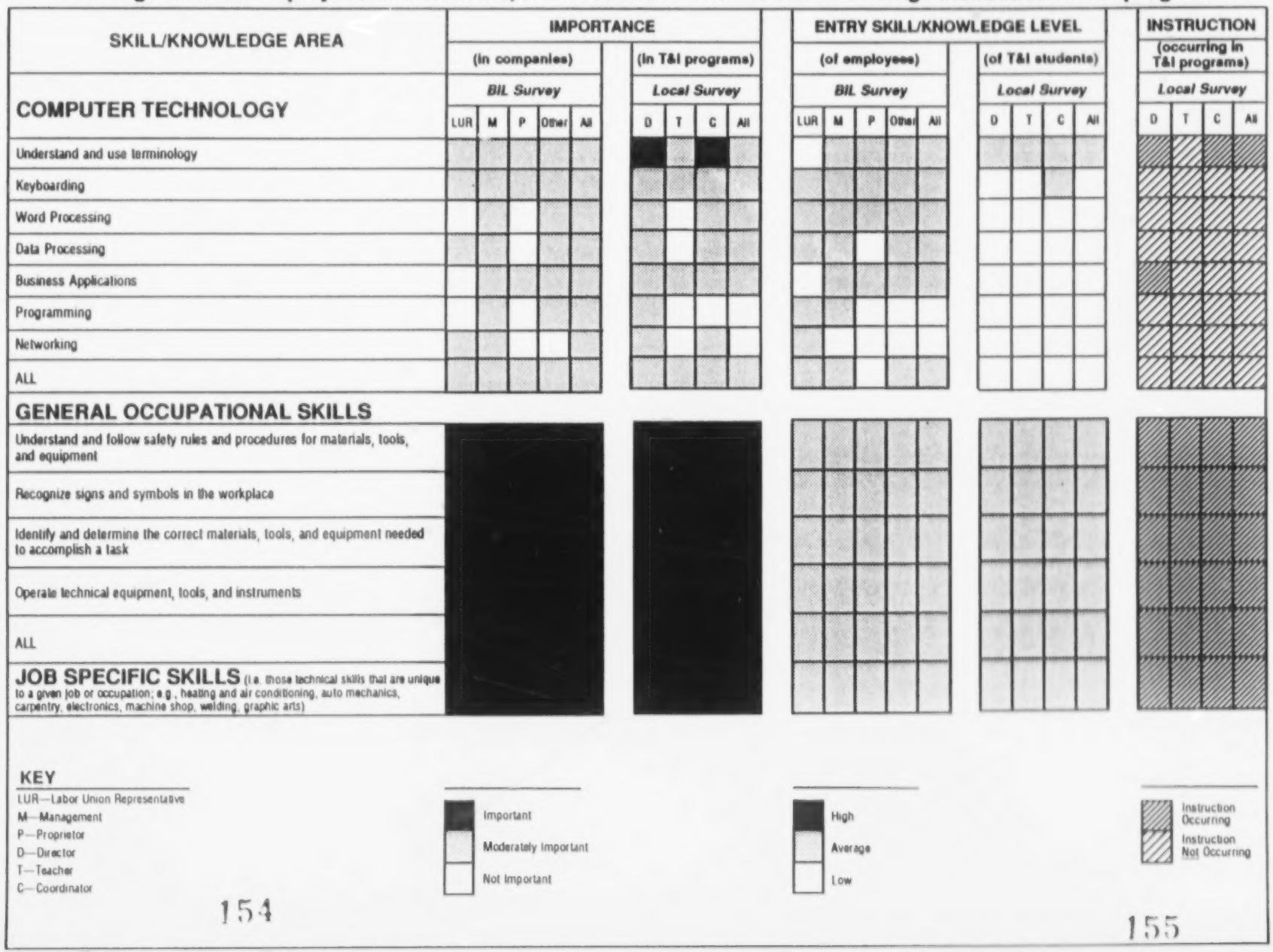
High
Average
Low

Instruction Occurring
Instruction Not Occurring

Importance of skills and knowledge in companies and trade and industrial (T&I) education programs, entry skill and knowledge levels of employees and students, and occurrence of skills and knowledge instruction in T&I programs



Importance of skills and knowledge in companies and trade and industrial (T&I) education programs, entry skill and knowledge levels of employees and students, and occurrence of skills and knowledge instruction in T&I programs



Importance of skills and knowledge in companies and trade and industrial (T&I) education programs, entry skill and knowledge levels of employees and students, and occurrence of skills and knowledge instruction in T&I programs